SECRET

25X1A

#12

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25X9

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ADMINISTRATIVE - ERD
Feasibility Study OS 1962-63

25X1A

[redacted]

SRD INDEX SYSTEM

prepared by

Electronic Data Processing
Office of Security Team

26 November 1962 10 o'clock

CONFIDENTIAL

II-2

27 MAY 1963

MEMORANDUM FOR: Director of Security

SUBJECT : Conversion of OS Index

1. The ADP/OS Policy Committee recently discussed the proposed implementation of the ADP Staff memorandum of 27 March 1963 regarding the conversion of the OS master index. This memorandum reiterated the position of the ADP Staff to provide personnel, space, funds, and equipment with the Staff assuming responsibility for the actual conversion (see Tab A). The ADP/OS Study Team submitted informally to the Committee for consideration an outline showing proposed steps for the accomplishment of the conversion (Tab B). The outline and Tab A cover the following points:

a. Location - 1900 Quarters I (Tentative). Office of Logistics has submitted this space for consideration. Coordination is being effected with the Survey Branch in this matter.

OS Comments -

The Office of Security position has always been that it is best if the entire conversion could be handled within the Headquarters Building. The handling of the conversion at any other location poses a number of items of concern as follows:

(1) Provision of transportation vehicle and two couriers approximately two hours each day for one year to shuttle the index cards between locations.

CONFIDENTIAL

(2) Inherent security risks in such transporting of cards.

(3) Approximately 60 index searches will be delayed each day as the cards involved will be at the conversion location. Thus, additional time in case processing and in handling expedite and special searches will result.

25X1A

Mr. [redacted] Executive Assistant to the DDS, has stated that the ADP Staff may have the space at Quarters I for the conversion operation and that this is the only space available at present.

b. Physical Security - Coordination is being effected with the Building Security Branch concerning badging of pool personnel. Three-way combination safes will be used for the housing of the index cards and other pertinent material.

c. Training - The Study Team will initially handle the training of editors and punch operators. Based on a 12-week cycle, four new pool employees will be reporting each week.

d. Operations - Courier runs will be made daily with a maximum of four trays (10,000 cards) out of the index for editing. All trays will be handled on a one-day cycle. Disruption of index searching will be kept to a minimum by this method. IBM cards will replace 3 x 5 cards rolldex by rolldex.

e. Personnel - Approximately 30 employees from the personnel pool will be used as editors and punch operators for the project on overt and semi-covert material. Only fully cleared staff employees will work on the covert

material upon completion of the overt and semi-covert conversion to punch cards.

OS Comment -

(1) Under the provisions of the 27 March 1963 DDP memorandum, the overt and semi-covert index cards would be handled by pool personnel (provisional) with the conversion of the covert cards accomplished only by fully cleared personnel. The ADP Staff will specifically identify the minimum number of fully cleared personnel required to complete the covert index of the project. Under this plan, the conversion will begin with the 25% of the overt and semi-covert cards that are not interfiled with the covert cards. The other 75% of cards are intermingled and will require fully cleared personnel and should be accomplished in the Headquarters Building.

(2) The Committee feels that it would be more efficient and effective to use fully cleared personnel for the entire project as:

(a) Provisionally cleared pool personnel would be used only on overt and semi-covert cards that would not be interfiled with the covert cards or 25% of the entire index.

(b) Training of many groups of persons would be required if pool personnel were used.

(3) A suggestion was made to contact the DDS again for the assignment of fully cleared people for a nine-month period with the view that after the conversion is completed, they be assigned to some other ADP project. By this method, as each rolldex of cards is converted to IBM cards, a partial computer operation could be initiated several months earlier over the system of utilizing pool personnel on overt and semi-covert cards

and fully cleared personnel on covert cards. However, it was pointed out to all present that the recent approval of the DD/S covered the matter of pool personnel for conversion of overt and semi-covert cards and fully cleared personnel for the conversion of the covert cards.

2. It is recommended that:

a. The Director of Security concur in the conversion at Quarters Eye with provisionally cleared personnel of the 25 percent of the OS index holdings that contain the overt and semi-covert cards that are not interfiled with the covert cards and that such conversion be initiated expeditiously.

b. The Director of Security and the Chief, ADP Staff, DD/S, contact DD/S to arrange for space within the Headquarters Building for the conversion of the remaining 75 percent of the index and to obtain a commitment from DD/S to provide fully cleared personnel for such conversion.

25X1A [redacted]

Chairman, OS Policy Committee

CONCURRENCE:

25X1A [redacted]

R. L. Bannerman, Director of Security

5 July 63

Date

A

Approved For Release 2000/05/31 : CIA-RDP83B00823R000100060002-9

12 April 1968

MEMORANDUM FOR: Chief, CIA Automatic Data Processing Staff
Director of Security
Director of Personnel

SUBJECT : ERD Index System Conversion Project

REFERENCE : Memo dtd 27 Mar 68 to ED/S fr C/AD[illegible], same subject

I have approved the conversion project outlined in the reference. In view of the critical shortage of space in the headquarters building and since the clerical personnel who are to do the work are located at 1016 16th Street, this would appear to be a preferable location. It is an important project and I wish to move forward with it as expeditiously as possible and to be kept advised of its progress.

L. K. White
Deputy Director
(Support)

cc: D/L w/ref

27 March 1963

MEMORANDUM FOR: Deputy Director (Support)

SUBJECT : SSD Index System Conversion Project

REFERENCES : A. Memo to D/S from C/ADPS, same Subj., dated 25 January 1963

B. Memo to C/ADPS from D/S, same Subj., dated 31 January 1963

1. This is to request your approval of the SSD Index Conversion Project as outlined in Ref A and concurred in by the Director of Security (Ref B).

2. The Project will be undertaken by this Staff contingent upon the satisfactory completion of a pilot operation now underway and your approval of the implementation plan as outlined below.

a. Personnel

A working force of thirty (30) persons in grades 3-5 will be required for a nine month period commencing 1 June 1963 to perform the conversion of approximately 1.7 million cards. Of the work force of 30 clerical personnel (clerk-typists and qualified typists excluded), 18 will be card punch and verifier machine operators, and 12 will be index card editors. These personnel will be assigned to this special Project from the clerical pool while in provisional clearance status. As full clearances are received on these individuals, they will be returned to the Clerical Assignment Branch/PCD for appropriate Agency staff assignments and will be replaced from the clerical pool by other provisionally cleared personnel. All personnel assigned to the Project will receive the necessary training by the ADPS in-house

and at local facilities (IBM Education Center on no cost basis) under the direct supervision of this Staff for the duration of the Project. Toward the final phases of the Project when the classified portions of the index system are ready for inclusion in the conversion, ASPS will specifically identify the minimum number of cleared personnel required to complete the Project. A decision will be made at that time regarding relative priorities for the assignment of available cleared personnel to this Project.

b. Funding

Personnel Services----------$90,000
30 x $4,620 (average) for 9 mos.

Machine Rentals----------$ 8,000
12 - 024 Punches
6 - 056 Verifiers } 9 mos.
1 - 548 Interpreter

Equipment/Supplies----------$ 5,000
Cards, trays, and holders

The ASPS has funds available in FY-63 to cover the above cost. However, since the funds to cover the personnel services may not be carried forward into FY-64, this Staff would transfer $90,000 to the Office of Personnel to provide for new and unplanned requirements related to recruitment activity.

c. Space/Logistics

Approximately 1600 sq. ft. of Headquarters space near the SAD would be desirable. However, arrangements would be made for special courier service if this Project were located in the downtown area. The Logistics Services Division is aware of the space requirement and will make every effort to locate the necessary space based on the relative priority given this Project.

SUBJECT: SRD Index System Conversion Project

Electrical wiring in the space would have to be modified to provide about 6 lines based on an average of 3 amps per machine.

The card punch and verifiers weigh approximately 250 lbs. each; the interpreter, 775 lbs. Hence, consideration of weight distribution of this equipment might be a critical point in locating this Project.

d. Security Considerations

The punching of the overt cards may be done by provisionally cleared employees. However, conversion of the smaller holdings of covert files in SRD will be accomplished by fully cleared personnel only.

e. Termination Procedures

At the conclusion of this Project on or about 31 March 1964, detailed personnel will be returned to Clerical Assignment Branch for appropriate staff assignment.

3. With your approval and establishment of a priority for this Project, the mechanics outlined above will be implemented forthwith in an effort to accomplish this task with economy, efficiency, dispatch, and a minimum of disruption to clerical personnel assignments.

4. It is therefore recommended that you approve the conversion plan as outlined above.

JOSEPH BERGER
Chief
CIA Automatic Data Processing Staff

See page 4 for concurrences and approval

SUBJECT: SRS Indian System Conversion Project

and at local facilities (IBM Education Center on no cost basis) under the direct supervision of this Staff for the duration of the Project. Toward the final phases of the Project when the classified portions of the Indian system are ready for inclusion in the conversion, ASPS will specifically identify the minimum number of cleared personnel required to complete the Project. A decision will be made at that time regarding relative priorities for the assignment of available cleared personnel to this Project.

b. Funding

Personal Services----------$90,000
39 x $4,000 (average) for 9 mos.

Machine Rentals----------$ 8,000
12 - 024 Punches
6 - 056 Verifiers } 9 mos.
1 - 548 Interpreter

Equipment/Supplies----------$ 5,000
Cards, trays, and holders

The ASPS has funds available in FY-63 to cover the above cost. However, since the funds to cover the personal services may not be carried forward into FY-64, this Staff would transfer $10,000 to the Office of Personnel to provide for new and unplanned requirements related to recruitment activity.

c. Space/Logistics

Approximately 1600 sq. ft. of Headquarters space near the SRS would be desirable. However, arrangements would be made for special courier service if this Project were located in the downtown area. The Logistics Services Division is aware of the space requirement and will make every effort to locate the necessary space based on the relative priority given this Project.

SUBJECT: SRD Index System Conversion Project

Electrical wiring in the space would have to be modified to provide about 6 lines based on an average of 3 amps per machine.

The card punch and verifiers weigh approximately 250 lbs. each; the interpreter, 775 lbs. Hence, consideration of weight distribution of this equipment might be a critical point in locating this Project.

4. Security Considerations

The punching of the overt cards may be done by provisionally cleared employees. However, conversion of the smaller holdings of covert files in SRD will be accomplished by fully cleared personnel only.

5. Termination Procedures

At the conclusion of this Project on or about 31 March 1964, detailed personnel will be returned to Clerical Assignment Branch for appropriate staff assignment.

3. With your approval and establishment of a priority for this Project, the conversions outlined above will be implemented forthwith in an effort to accomplish this task with economy, efficiency, dispatch, and a minimum of disruption to clerical personnel assignments.

4. It is therefore recommended that you approve the conversion plan as outlined above.

JOSEPH DECKER
Chief
CIA Automatic Data Processing Staff

See page 4 for concurrences and approval

SUBJECT: SRD Index System Conversion Project

CONCURRENCE: /s/ Lucille D. Eckert
Director of Personnel
DATE: 5 APR 1963

CONCURRENCE:
Director of Security
DATE:

APPROVED:
Deputy Director (Support)
DATE:

Distribution:
Orig. - C/ADPS
1 - DD/S
1 - D/Pers
1 - D/S
1 - D/L
1 - Controller

B

Approved For Release 2000/05/31 : CIA-RDP83B00823R000100060002-9

SRD INDEX SYSTEM CONVERSION PROJECT

1. Background

2. Location - 1900 Quarters I.

3. Security

   a. Physical - Special Badges. Use of 3 way safes for cards.

   b. Personnel - Personnel pool people will be available for 10-12 week period. Full clearance procedures required for work on covert cards.

4. Proposed operation:

   a. Sequence of converting present 3 x 5 index cards.

      1) Courier run to Quarters I. Build up to 4 trays/day (10,000 cards), based on desired 9 months desired completion schedule.

      2) Editing of 3 x 5 cards. Teams of 4-6 editors will complete 1 tray per day. Editor rate: 400-600 cards per day.

      3) Return of cards to SRD index based on one-day cycle for each tray. Disruption of index search routine will involve 12 index checks/10,000 cards/day.

      * ~~4) Microfilming of edited 3 x 5 cards in SRD can be accomplished at 5000 cards/hour (camera will be supplied by ADPS).~~

      * ~~5) Processing and return of microfilm reels to Quarters I.~~

      * ~~6) Punching operation will be done from microfilm viewers. (Operator rate: 100/hr)~~

      * ~~7) Verifying operation will also be done from microfilm viewers. (Operator rate: 200/hr)~~

* These steps were discussed and deleted. Punching will be from the edited and coded cards and verified immediately.

-8)- 4) Printing of IBM card by interpreter at Quarters I.

-9)- 5) Machine sequencing and merging of masters and trailers.

-10)- 6) Replacing of 3 x 5 cards by IBM cards Rolldex by Rolldex

b. Creation of new index cards during conversion. A new preprinted form will be used. All cards to be typed will be placed in 3 categories:

1) Those going to unconverted portion of index will be typed on preprinted 3 x 5 cards and placed in the index.

2) Those going into alphabetic area of the index being converted (4 cards per day - .6 of 1% of 600). Punch in SRD and manually insert in IBM cards as they are entered into the system.

3) Those going into IBM portion of index. Punch, verify, and print in SRD, then insert in IBM card index. This group will grow from 0 to 600/day as project proceeds. Machine work can be done at Quarters I until SRD equipment arrives.

5. Personnel and Training:

a. Based on 12-week cycle: 4 new people/week.

b. Editor training period: 2 weeks.

c. Machine operator training: 1 week.

6. Anticipated Schedule:

a. Pilot project report due late May.

b. Computer tape index lookup demonstration will be given in late May or early June.

c. Site can be ready early June.

d. Machines due late June.

e. Editor training could commence in early June.

22 April 1963

SEARCH CRITERIA - SRD INDEX SYSTEM

1. The search program has been written for the 1401 and will utilize 3 tape drives. For the demonstration, no effort has been expended to produce greater efficiency by making use of special features (such as overlap capabilities), or the additional tape drives available on the 1410. Also, blocking of records on the Master Index tape has been restricted to a maximum of 11 to provide realism, and to utilize core in the magnitude that may be provided on a 1401 system.

2. Only one generalized search program is being written. It will allow any given personal name to be searched against the Master Index in any one of five degrees of "hardness". No provision has been made for an automatic second level of search against aliases, pseudonyms, AKA's and Nee names developed from the first search, since the Master Index is limited to a small segment of the alphabet. If names are developed which could be searched in the portion of the Index which has been recorded on tape, a second (or more) search record can be created and the search may be rerun on the basis of the additional search requirements.

3. All searches will be tied together by means of a Search Number--a five digit numeric code, the first two digits of which identify the Requestor or Requesting Office; the next three digits are sucessively assigned to each name submitted by the Requestor for an Index Search. All requests from a given Requesting Office are brought together at the

conclusion of the Search, in order to provide the Requestor with a consolidated listing of search results.

4. The five types of searches, any one of which the Requestor may specify for any submitted name, are:

TYPE 1. Print all records with Last Name, First Name and Middle Name identical, and Date of Birth (where D.O.B. is provided in the Master Index) plus or minus five years.

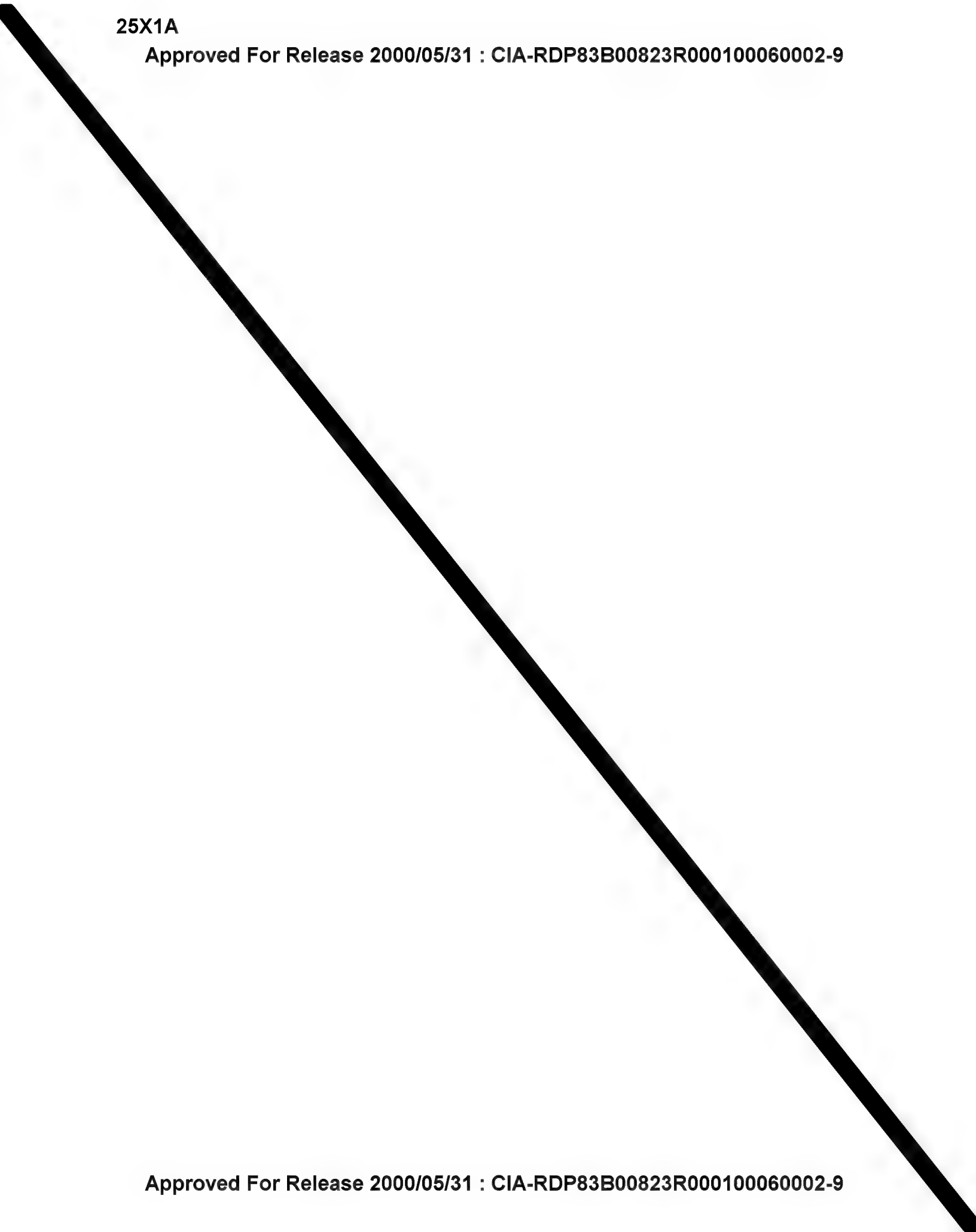
TYPE 2. Print all records with identical First Name, Last Name and Middle Initial.

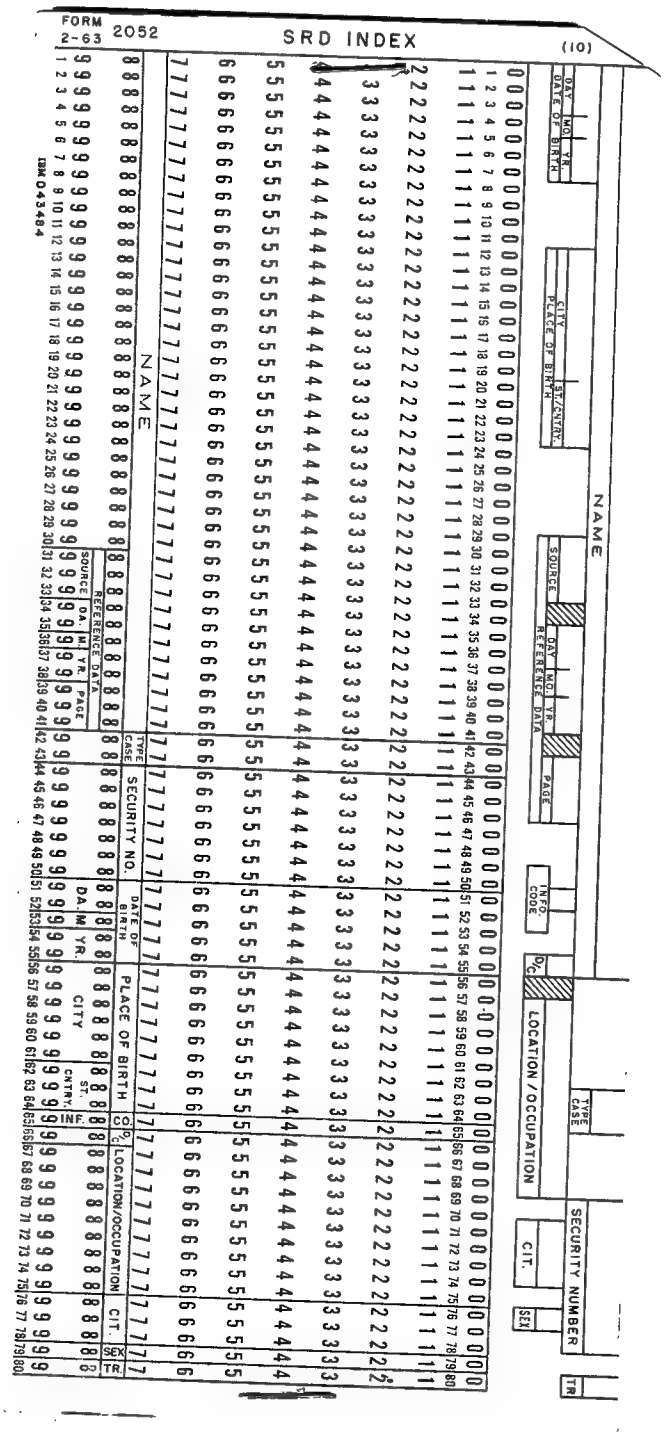
TYPE 3. Print all records with Last Name and First Name identical, and and all records with identical Last Name and First Initial, where First Initial only is contained in the Master Index.

TYPE 4. Print all records with identical Last Name.

TYPE 5. Do Type 1 Search, and if result negative, print out records hi and lo of the name requested.

TYPE 6. (When full Last Name, but only first and/or middle initial is provided in the Request.) Print all records with identical Last Name and same initial or initials.





C O P Y

12 April 1963

MEMORANDUM FOR: Chief, CIA Automatic Data Processing Staff
Director of Security
Director of Personnel

SUBJECT : SRD Index System Conversion Project

REFERENCE : Memo dtd 27 Mar 63 to DD/S fr C/ADPS.
same subject

I have approved the conversion project outlined in the reference. In view of the critical shortage of space in the headquarters building and since the clerical personnel who are to do the work are located at 1016 16th Street, this would appear to be a preferable location. It is an important project and I wish to move forward with it as expeditiously as possible and to be kept advised of its progress.

/s/ L. K. White

L. K. White
Deputy Director
(Support)

CC: D/L w/ref

C O P Y

27 March 1963

MEMORANDUM FOR: Deputy Director (Support)

SUBJECT : SSD Index System Conversion Project

REFERENCES : A. Memo to D/S from C/ASPS, same Subj., dated 25 January 1963

B. Memo to C/ASPS from D/S, same Subj., dated 31 January 1963

1. This is to request your approval of the SSD Index Conversion Project as outlined in Ref A and concurred in by the Director of Security (Ref B).

2. The Project will be undertaken by this Staff contingent upon the satisfactory completion of a pilot operation now underway and your approval of the implementation plan as outlined below.

a. Personnel

A working force of thirty (30) persons in grades 3-5 will be required for a nine month period commencing 1 June 1963 to perform the conversion of approximately 1.7 million cards. Of the work force of 30 clerical personnel (clerk-typists and qualified typists evaluted), 18 will be card punch and verifier machine operators, and 12 will be index card editors. These personnel will be assigned to this special Project from the clerical pool while in provisional clearance status. As full clearances are received on these individuals, they will be returned to the Clerical Assignment Branch/PSD for appropriate Agency staff assignments and will be replaced from the clerical pool by other provisionally cleared personnel. All personnel assigned to the Project will receive the necessary training by the ASPS in-house

and at local facilities (Ben Education Center on no cost basis) under the direct supervision of this Staff for the duration of the Project. Toward the final phases of the Project when the classified portions of the index system are ready for inclusion in the conversion, ADPS will specifically identify the minimum number of cleared personnel required to complete the Project. A decision will be made at that time regarding relative priorities for the assignment of available cleared personnel to this Project.

b. Funding

Personal Services----------$30,000
30 x $5,000 (average) for 9 mo.

Machine Rental----------$ 8,000
12 - 024 Punches
6 - 056 Verifiers } 9 ea.
1 - 503 Interpreter

Equipment/Supplies----------$ 5,000
Cards, trays, and holders

The ADPS has funds available in FY-63 to cover the above cost. However, since the funds to cover the personal services may not be carried forward into FY-64, this Staff would transfer $30,000 to the Office of Personnel to provide for new and unplanned requirements related to recruitment activity.

c. Space/Logistics

Approximately 1600 sq. ft. of Headquarters space near the SAO would be desirable. However, arrangements would be made for special courier service if this Project were located in the downtown area. The Logistics Services Division is aware of the space requirement and will make every effort to locate the necessary space based on the relative priority given this Project.

SUBJECT: SRD Index System Conversion Project

Electrical wiring in the space would have to be modified to provide about 6 lines based on an average of 3 cups per machine.

The card punch and verifiers weigh approximately 250 lbs. each; the interpreter, 775 lbs. Hence, consideration of weight distribution of this equipment might be a critical point in locating this Project.

d. Security Considerations

The punching of the overt cards may be done by previously cleared employees. However, conversion of the earlier holdings of covert files in SRD will be accomplished by fully cleared personnel only.

e. Termination Procedures

At the conclusion of this Project on or about 31 March 1964, detailed personnel will be returned to Clerical Assignment Branch for appropriate staff assignment.

3. With your approval and establishment of a priority for this Project, the mechanisms outlined above will be implemented forthwith in an effort to accomplish this task with economy, efficiency, dispatch, and a minimum of disruption to clerical personnel assignments.

4. It is therefore recommended that you approve the conversion plan as outlined above.

[redacted] 25X1A

JOSEPH ESSIG
Chief
CIA Automatic Data Processing Staff

See page 4 for concurrences and approval

Approved For Release 2000/05/31 : CIA-RDP83B00823R000100060002-9

SUBJECT: [redacted] Index System Conversion Project

CONCURRENCE: /s/ Emmett D. Echelis DATE: 5 APR 1963
Director of Personnel

CONCURRENCE: [redacted] DATE: 4 APR 1963
Director of Security

APPROVED: /s/ DATE:
Deputy Director (Support)

Distribution:
Orig. - D/ADPS
2 - [redacted]
1 - D/Pers
1 - D/S
1 - D/L
1 - Controller

MAR 2 3 00 PM '83

0-DD\2

Relative Advantages of Paper Tape Versus Punch Cards

I. PURPOSE:

This paper compares the relative advantages of paper tape versus punch cards to produce a machine language by-product during a normal typing operation.

II. DISCUSSION:

The specific application of concern here involves the production of the 3 x 5 cards now being typed in SRD for insertion in the Office of Security indices. The best paper tape producing equipment is manufactured by Friden, Incorporated, and is known as Flexowriter. The best punch card equipment available today is manufactured by IBM and is known as the typewriter card punch model 526. The criteria for determining what type of subjects or references should be carded are not material in this situation. What is material is the format and content of the card. In order to determine the relative advantages of the two systems, the following basic comparisons should be considered:

1. Unit Record Length

If the unit record length is above 80 characters, the punched card system will require the use of trailer cards. This is not particularly troublesome if the above 80 character unit records are a relatively minor portion of the total number. However, this becomes a more time consuming operation if there is a substantial number of these trailer cards. Punched paper tape is continuous and allows unit records of indefinite length. It has been determined that the desired unit record length will be less than 80 characters in all but a very small percentage of the cases. See Tab A.

2. Use of the Machine Language By-product

If the data so developed is to be stored and merely "dumped" into a computer eventually, either system could be used. However, if it is desired to utilize the developed data in the

reporting and/or control systems, punch cards would have to be used. In the present study, it has been observed that punch cards could be usefully employed in both the reporting and control systems.

3. Machine Delivery Time

Both flexowriter and IBM typewriter punch card machines require approximately four months delivery time. Flexowriters must be ordered by specific model and include modification specifications. IBM typewriter punch card machines are standardized and, therefore, can be ordered by merely model numbers. Since the Office of Security has an IBM representative assigned to it from the ADP Staff, it was possible to informally back order IBM Model 526 machines in May upon the contingency that these machines may be the ones desired. This means that delivery can be obtained in September 1962.

4. The Method of Computer Storage

The two most logical computer storage methods available are either magnetic tape or random access central storage memory. If magnetic tape is used, it will be necessary to have the accumulated data sorted alphabetically either on EAM equipment (by means of punch cards) or by the use of higher cost (approximately $200 an hour) computer time, since the subsequent searching operations will have to be conducted in an alphabetical serialized fashion. If, however, random access storage is utilized, the information can be inserted in the computer in a random fashion as far as the alphabetical sequence is concerned. The dominating factors in deciding which storage method will be used will be first, the cost of the two methods and, second, the total storage requirements of the complete system. In relatively small storage systems (100,000,000 characters or less) the random access type is more desirable and is not significantly more expensive than the use of magnetic tape. In large storage systems (100,000,000 characters or over) the cost tends to favor the use of magnetic tape with serial access techniques. In addition, the state of the art is now limited to about 200,000,000 characters for a system of random access type storage. Assuming an average unit record length of approximately 60 characters, the present indices system alone would contain 90,000,000 characters which raises the question of the feasibility of a random access system. This is particularly true in view of the other requirement of the Office of Security,

as well as program requirements which will require millions of additional characters. If there is a good chance that serial access may be necessary because of the need for a large number of characters, the punch card system would be favored because the information can be correlated alphabetically through relatively simple EAM methods. If, on the other hand, the system is clearly going into a random access memory, then the difference between punch paper tape or punch cards would be minimal. It is concluded that there is a reasonable possibility that the data may go into magnetic tape storage which will require the serial access method.

5. The Choice and Cost of Computer Equipment

At the present time the Office of Security, as part of DD/S, has available to it the RCA 501/IBM 1401 combination. This system will accept punched paper tape directly into the RCA computer or punched cards into the 1401 peripheral computer. The RCA 501 is presently overloaded with work and the 1401 (which will be installed sometime in late 1962) is now being programmed for certain DD/S applications. At this stage of the DD/S ADP planning, it is impossible to predict (1) the availability of this equipment, or (2) the advisability of having a separate computer for the Office of Security. In any event, however, the final decision as to what computer equipment will be used will have to be made on the basis of the total needs of the Office of Security and the other DD/S elements. Since no firm prediction can be made in this area at this time, this factor will have to be left unresolved.

6. The Choice and Cost of EAM Equipment

The cost of the actual typing-punch equipment to produce the machine language by-product, is known. It is estimated that it will take three machines in SRD to produce new indices cards now being typed and one machine in the typist pool for the consolidation program. If the machines are purchased, each IBM machine would cost approximately $5,000 plus $200 a year maintenance, and each flexowriter would cost approximately $3,000 plus $200 a year maintenance. On a rental basis the IBM equipment would cost $120 a month in contrast to the flexowriter which would cost approximately $200 a month. Thus, if punch card equipment is desired, rental is indicated. If punch paper tape equipment is desired, purchase is indicated.

7. Verification

At the present time the operators producing the 3 x 5 cards have been using sight verification. With the production of machine language by-product, the possibility of machine verification presents itself. Statistics generated over a long period of time have indicated that normal two person sight verification rarely exceeds 95% accuracy. This means we may expect a 5% or higher typing error in the index cards under the present system. This error rate, of course, can be influenced by the degree of care taken in the sight verification techniques. Many studies have also shown that with machine verification there is significantly less than 1% error. Machine verification would include only the name and file number. This can be accomplished by the IBM Model 826.

8. The Form of the Printing in the Machine Output

This will vary depending upon the system used. Only all capitals will be available in the punch card system. The flexowriter provides both upper and lower case letters.

9. The Element of Storage of the Cards or Tape

Depending upon the average unit record length of the punch cards, the actual storage volume used by the punch paper tape versus punch cards can be as high as 10 to 1 in favor of the punch paper tape. In any event, however, the total volume involved here is something that can be placed in one part of a small room even if the punch cards were used. This does not appear to be a significant factor since space is available at the Records Center.

10. Typing Error Correction

On a flexowriter this is accomplished by normal back-spacing and cancelling of the letters by depressing the error key. These positions on the tape then represent plain tape feed through code which means in effect nothing to the retyping or transfer to storage operation. An error made on a punch card requires the removal of the punch card from the machine and the retyping of a new punch card. If an error is made near the end of the unit record which is producing a punch card, the operator must retype practically a whole new card. Therefore, in an average unit record length of 60 characters, the average retyping upon making an error is 30 characters.

11. Speed and Accuracy of Typing

This applies equally well to either system since in either case the same standard keyboards are used.

12. Training of Operators

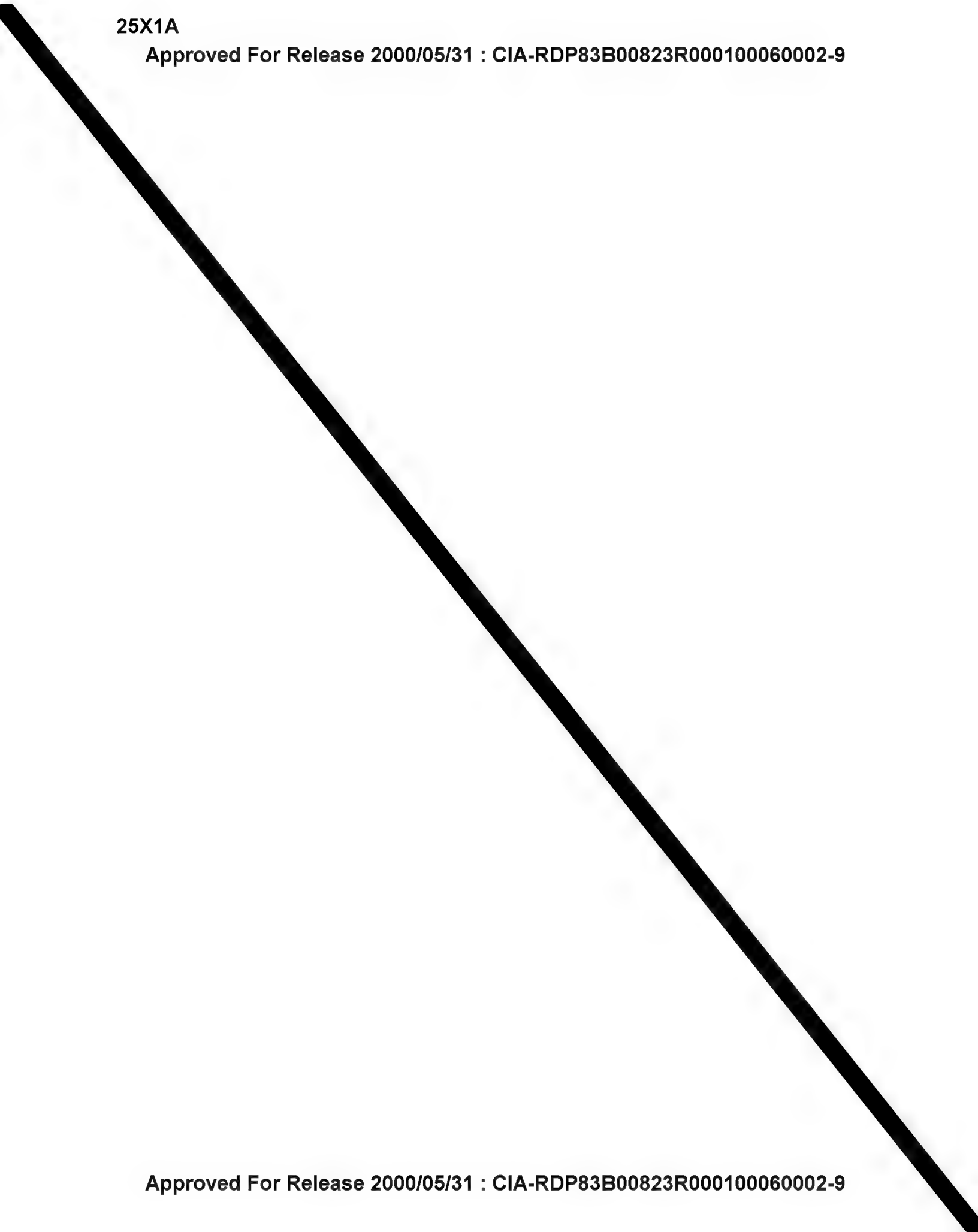
This factor applies equally to either system, but it must be considered in sufficient time to have the operators trained for the equipment to be ordered. The training period for the typical typist is a matter of a few days.

13. Later Conversion and Reformating Techniques

To be able to put the machine data into a computer memory, it will be necessary to provide certain codes and formats before the raw data can be "dumped" into the computer. The method and extent of desired retrievability of the various elements of the unit record will determine the complexity of the programming involved into getting information into the computer. If the program is properly planned, this problem will not affect the favoring of one system over the other.

14. Speed of the Input to the Computer

This is a relatively minor factor. However, the input speed of cards is somewhat higher than that for punch paper tape. This would mean in the initial "dump" as well as subsequent operations, somewhat less computer time will be necessary if punch cards are used.



Special application -

paper tape to mag tape

Small group of holdings - (card)
On the head searching testing - one program abandoned

Generalized search, retrieval and updating routine (program) - 1410

1 man year by IBM empl

Nothing signifcant at present - 6 man team starting tape to random access

****

200,000,000 characters

80 x 1.6 M - 128,000,000

will outgrow quickly

25X1A [redacted] machines cannot accomodate us with all of his activities -

Reformat on computer - send him 3.5 c/ards

[redacted] ARGUMENT

1. UTILIZE EXPERIENCES OF HIS GROUP
2. QUESTION BENEFITS OF REPLACING 3x5 CARD
3. EMPHASIZES PROBLEMS
   a. TRAILER CARDS
   b. CARDS WEAR THROUGH USAGE
   c. CREATION OF CODE SYMBOLS - DIFFICULT FOR OS ANALYSTS TO INTERPRET
   d AWKWARDNESS OF PUNCHED CARD STORAGE AND SEARCHING
4. UTILIZE VARIABLE FIELD CARD RECORD - ANALOGOUS TO RF - SO COMPILER PROGRAMS WRITTEN BY RF FOR VALNUT COULD BE UTILIZED BY OS.

I. Initial premise - system based on existing hardware - no R&D funds

OS index geared to reqmts of OS rather than RDID & DDP

At present OS has primarily a file system - not a document retrieval system

Index system only one program - other planned programs for OS & NAC will be punched oriented.

II. Analysis -

RID - contracting 8M card index - 300,000 plus files

SRD - 1,6 M, 300,000 plus files
Simultaneous conversion and shift to machine language on new cards feasible to OS

RID - cards indexed to documents - each card has abstract of info in doc. Cards also indexed to documents in dossiers.

OS - cards have short record length; no abstract; all indexed to files

Abstracts will be generated and retrieved as part of secondary retrieval program (to be merged with index info in mag tape system)

III. Name searched

Name variants - not signifcant to OS - on the head type searched.

RID System available for pertinent name checks to OS -- not an overall reqmt. to use system.

IV. - Reconciliation of paper tape and 3x5 requires updating all changes in both conversion to mag tape (or random storage)

will require code conversion and alphabetic reassembly (by computer means) of converted material, changes and new entries

V. - EAM advantages availabel with punched cards.

VI. - Costs

a. Flexowriter vs. punched machines (2:1)

b. Verification equipment (flex-new, complicated and costly)

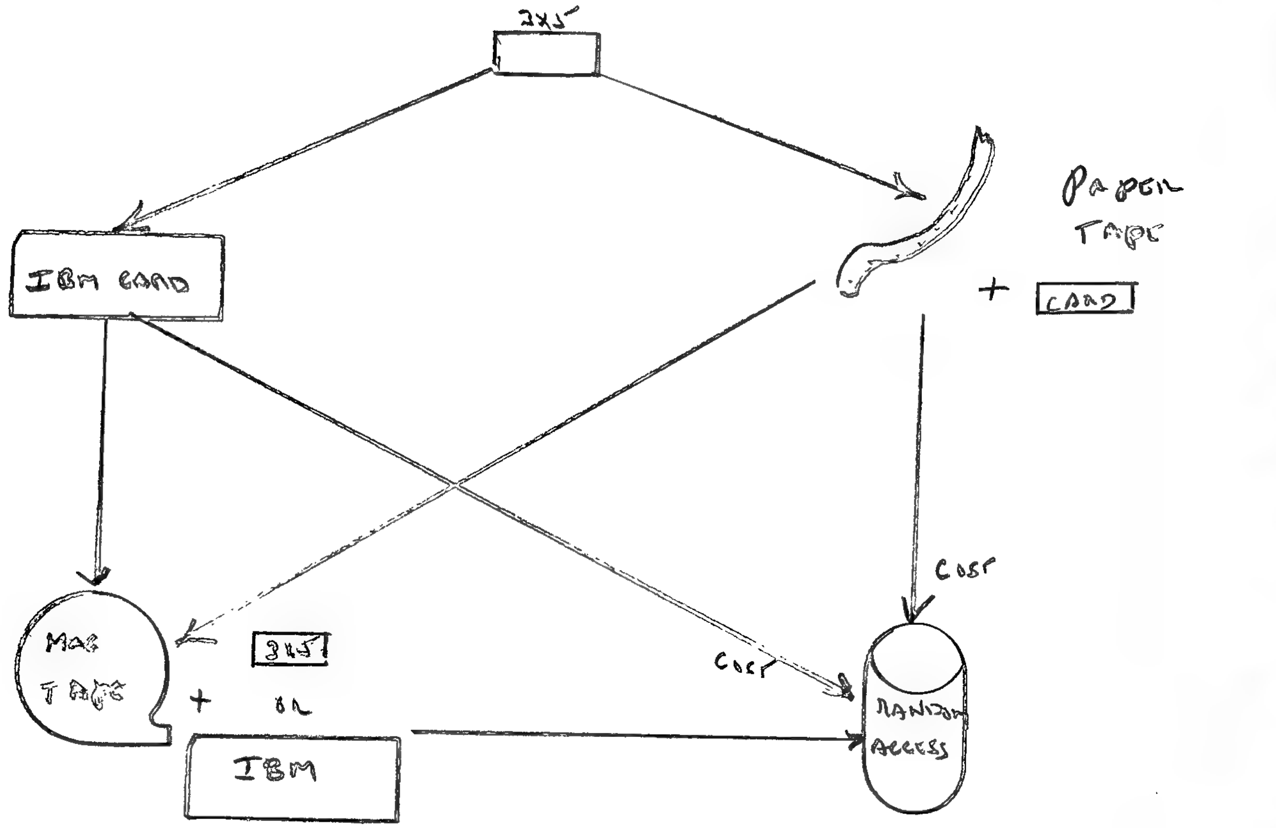
c. Random access vs. tape ($20,000 mo. : 1/3 of $9,000)

d. 1401 computer time available

VII. Time — value concept or RAMAC vs. mag tape.

Misc. -

No reference cards furnished to RID
Overt ref. cards are furnished
No cards at present from RID
OS files not available for review
Criteria difference - RID vs. OS (indexing)



INITIAL PREMISE
AVAILABLE HARDWARE
NO R&D FUNDS
OS- FILE SYS AT PRESENT - NOT DOC
INDEX - ONLY ONE PROGRAM
CARD ORIENTED

ANALYSIS
RID CONTRACTING
OS EXPANDING
RID - INDEXED TO DOC. + DOSSIERS
OS - SHORT CARD LENGTH
RID - INDEFINITE

NAME SEARCHES
VARIANTS
ON THE HEAD
CAN UTILIZE -

PAPER TAPE
UPDATING CHANGES, DELETIONS
CONVERSION TO MAG TAPE
CODE CONVERSION + ALPHABETIC REASSEMBLY

EAM ADVANTAGES
...TS
FLEXO VS. PUNCHED MACHINES (2:1)
VERIFICATION EQUIP - COSTLY ...
RANDOM ACCESS ... (20,000 ...)
1401 COMPUTER TIME AVAIL.

1. System Concept and Development

   a. Initial premise of system study was based on available hardware--No R & D funds.

   b. Compatibility - OS index is geared toward requirements of OS rather than to RID index or DDP systems. Data interchanged between OS and RID will be compatible.

   c. OS has primarily a file system and not document retrieval system.

   d. Index system only one program - other planned programs for OS and the National Agency check activities will be punched and oriented.

   e. Optional routes to random access.

2. Analysis of Present Holdings

   a. RID : A contracting 8M card index, 300,000 + dossiers; SRD: expanding 16M card index, 300,000 + files, simultaneous conversion and shift to machine language on new cards feasible in OS.

   b. RID cards indexed primarily to documents--each card has abstract of info in document. Cards also indexed to documents in dossiers.

   c. OS cards have short record length; no abstracts; all indexed to files.

   d. Abstracts will be generated and retrieved as part of a secondary retrieval program (to be merged with index info in mag tape system)

3. Name Searches

a. Name variants not a significant problem to OS. Primarily on the head type searches.

b. RID system available for pertinent name checks to OS--not an overall requirement to use system

4. Reconciliation of paper tape and 3 x 5 cards--requires updating all changes in both conversion to magnetic tape (or random storage) will require code conversion and alphabetic re-assembly (by computer means) of converted material, changes and new entries.

5. Certain EAM advantages available with punched card index.

6. Costs:

a. Flexowriter vs. Punch machines (2:1)

b. Verification equipment. (flex-new, complicated and costly)

c. Random access vs. tape ($20,000 : 1/3 of $9000)

d. 1401 computer time available

7. Time--value concept or ramac vs. mag tape

CONFIDENTIAL

11 February 1963

25X1A

MEMORANDUM FOR: [redacted]

SUBJECT : Office of Security, Pilot Operation

1. Although we do not have full approval of our program for OS from the DDS we do have a tentative approval from the Office of Security and a clear track ahead for the operations concerned with the pilot recommendation. Therefore, I am requesting that responsibilities for this phase of the operation be delegated as follows:

25X1A
25X1A

a. [redacted] should concern himself with the matter of readying the 3 x 5 index data for key punch operations. This should be done by selecting areas within the large file which are approximately 1000 index cards or more in depth. These cards should be reproduced to provide a duplicate set of documents for editing and key punching operations without disturbing the main file. Identity of the areas used should be maintained within the main file so that future additions to these sections can be routed to the pilot operation to test computer updating operations. The reproduced copies of the file should be used as the key punch source. Appropriate instructions for marking or editing this data for punching should be developed. [redacted] himself, plus whatever clerical help is necessary should perform this editing. A careful log should be kept, indicating the nature and extent of any data loss and difficulties experienced in preparing the data for punch operations. Necessary additions to the editing instructions should be made as the editing

25X1A

CONFIDENTIAL

progresses. Daily additions to the controlled sample should be held in a separate group so that they may be edited and used to update the controlled sample. The preliminary work in this area (reproduction of index, edit instructions, code lists, etc.) should be completed so that the actual editing operation can begin by the end of February.

25X1A

b. [redacted] Specifications for computer programs required for updating the master file and name searching functions should be developed. These programs should be simplified versions and not necessarily the kind of programs that would be ultimately required in a fully operational system. A program should be developed to show serial name searching on tape by 1 May and random name searching by the time the disc equipment is delivered for CHIVE. If possible random search should be done on other equipment sooner. A statistical analysis of the records should be made to determine such information as: number of trailer cards required by cause, number of times a particular type of data item was recorded, name truncation, etc. If programming assistance is required, the extent of this requirement should be made known to [redacted] 25X1A

25X1A

c. [redacted] As matters now stand, you
25X1A should concentrate on the pilot conversion and demonstration. [redacted] with guidance from Joe Becker, will pursue the personnel, space and fund requirements with appropriate personnel at the DDS level. If a special project group cannot be established for the full scale conversion we may have to reconsider contracting this work. However, these are decisions that need not delay the pilot operation. For the present I would like you to concern yourself with the finalizing of the IBM card which we will order, the preparation of suitable key punch instructions for this card, and the necessary arrangements with key punching personnel
25X1A in [redacted] shop and [redacted] for the pilot operation.

We should be prepared to start key punching operation by 1 March. I look to you for overall coordination of the project so that it can be completed in a satisfactory manner on schedule. I would like you to call upon [redacted] for technical help and advice whenever you feel his extensive punch card and computer experience can be helpful. 25X1A

2. On Fridays after the conclusion of our regular staff meeting I would like to meet with the entire group for the purpose of discussing each weeks progress and the job ahead.

25X1A
[redacted]

cc: Becker

25X1A [redacted]

SECRET

8 February 1963

MEMORANDUM FOR: Director of Security
Chief, Personnel Operations Division, OP
Chief, Records Integration Division
Chief, FI Division D
Chief, CI/R&A

SUBJECT: Common Personality Numbering System

1. In the light of favorable responses received from the components concerned, we believe that a common numbering system for personalities of Agency personnel, security, counter-intelligence, or other operational interest should be established. I have forwarded the attached draft of a headquarters Notice to DDP Publications Control for coordination and publication in the Agency system.

2. Below are detailed provisions which need not be a part of the Notice. The number series to be used by the Office of Security runs from 365,000 to 724,999. RID will use numbers beginning with 725,000 to 999,999. New series will be assigned when either of these run out (approximately 1970).

3. An exception requested by the Office of Personnel should be agreeable to all concerned, and for obvious reasons should not be published in the Notice: In the Office of Personnel, Staff Agents will not be identified by the serial number used for the same individuals in Staff Employee status.

4. Having reviewed the reactions of all concerned, there remain, so far as I am able to perceive, no obstacles to the adoption of this procedure effective 1 April 1963. On the same date, in accordance with its prior agreement, the Operational Approval Group of the CI Staff should cease assigning "C" numbers to new cases using 201 numbers instead. A Notice supplementing the proposed HN to this effect should be published in the CS.

5. Any needed refinements may, of course, be introduced into the wording of both Notices during the process of coordination.

[redacted]
Chief, DDP Systems Group

25X1A

Attachment:
Draft Notice

SECRET

Next 3 Page(s) In Document Exempt

ROUTING AND RECORD SHEET

SUBJECT: (Optional)
ADP Study of the Office of Security

FROM:
25X1A [redacted] 4-E-42

NO.

DATE
25 January 1963

TO: (Officer designation, room number, and building)	DATE RECEIVED	DATE FORWARDED	OFFICER'S INITIALS	COMMENTS (Number each comment to show from whom to whom. Draw a line across column after each comment.)
1. Chief, A&TS		25 Jan	[redacted]	The attached report from ADP Staff is the result of a joint effort between ADPS and OS. Within the last few days, we have had meetings with ADPS and suggested changes to their report and transmittal letter. Changes suggested by the Office of Security have been incorporated in the ADPS report and transmittal letter. The report and transmittal letter have the approval of the OS Policy Com-
2. Executive Officer		29 Jan	[redacted]	
3. Deputy Director of Security				
4. Director of Security				
5. [redacted] 25X1A				
6.				[redacted]
7.			25X1A	
8.				Administration and Training Staff also concurs in the presentation from a support standpoint.
9.				
10.				Page 42 of the Report shows the schedule of implementation of the conversion of the SRD/OS Index.
11.				Copy of ADPS PROGRESS REPORT TO DDS IS ATTACHED
12.				A memorandum of reply to the Chief, ADPS, is attached for your signature.
13.				A memorandum in reply to Col. White's inquiry on the status of ADP operations in the Office of Security is also attached for your signature.
14.				Recommend concurrence and signature as above.
15.				

FORM 610 USE PREVIOUS EDITIONS DEC 56 ☐ SECRET ☒ CONFIDENTIAL ☐ INTERNAL USE ONLY ☐ UNCLASSIFIED

U. S. GOVERNMENT PRINTING OFFICE: 1958 O - 476731

SECRET

31 JAN 1963

MEMORANDUM FOR: Deputy Director (Support)

SUBJECT : ADP Study of the Office of Security

REFERENCE : Memo from DDS to D/Sec and Chief, ADPS, dtd 19 Jan 63, subj: ADP Study of the Office of Security

1. In accordance with the reference, I wish to report that the ADP Staff has submitted its study on the conversion of the SRD/OS Index System. A copy of such report and my reply thereto are attached. You will note that this Office endorses the ADP report and its recommendations with certain limitations regarding personnel, equipment, space, and funds.

2. If further information is required in answer to your referenced memorandum, I would be pleased to give you further information if necessary.

SIGNED

Sheffield Edwards
Director of Security

Attachments

Distribution:
Orig. & 1 - Adse.
1 - ES/OS
25X1A 1 - Chrono

ES/OS: [redacted] ttc (25 Jan 63 - X6840)

SECRET

28 January 1963

MEMORANDUM FOR: Deputy Director (Support)

SUBJECT : ADP Study of the Office of Security

REFERENCE : Your memo for D/S and C/ADPS dtd 15 Jan 63, same subject

This is in response to your request for a status report on the Phase II ADP study of the Office of Security, and of the other DD/S elements.

OFFICE OF SECURITY

1. Attached, for your information, is a copy of an initial Phase II report which together with a set of draft recommendations was sent on to the Office of Security for its consideration.

2. This report is a synthesis of the best judgment of a group of analysts from OS, ADPS, and IBM who have been working on the study for the past half year. It recommends an action program, to commence as soon as possible, leading to the conversion of OS 3x5 index records to "machine language." As this progresses, the plan also calls for a series of computer demonstrations (using Project CHIVE hardware) designed to acquaint OS management with the results available with a fully automated system.

3. OS is currently reviewing the essential elements of information which it wishes to incorporate into the machine language record. This step is basic and of paramount importance because it will dictate the pace and the method of conversion processing. Converting the file is an arduous and time-consuming task. It will take temporary

SUBJ: ADP Study of the Office of Security

manpower, some rented equipment, and cost about $90,000. ADPS budgeted for this purpose, and we are now negotiating with OP to determine if cleared pool personnel can be made available.

4. During the full scale conversion of the index to machine language, we will utilize a narrow segment of the index and CHIVE facilities to develop a fully automated system for updating, name checking, and statistical functions.

OTHER DD/S ELEMENTS

Since last September, ADPS has held numerous conferences with DD/S components to ascertain their current and projected ADP requirements. Although a formal set of conclusions and recommendations will be submitted to you in the spring, I think it is possible now to advance some impressions:

1. In a gross sense, the DD/S has no uniform ADP interest that is shared by all its components. Each DD/S office has a specialized mission; they operate independently and possess few system interests in common. There are many management, accounting, statistical, and reporting functions which can be improved through the development of efficient ADP applications. Collectively they represent the "bread and butter" applications of the DD/S. These projects call for a close working relationship between the consumer, who must define his needs; the ADP Staff, which must develop the over-all processing system; and the ADPD, which must evolve the computer programs for actual production.

2. Potential ADP application is most conspicuous in COMMO, OS, and LOG:

a. COMMO, because of the volume of machine language it possesses and uses in its transmission functions--plus its many engineering applications and special requirements for field computers. (A requirement for an on-line computer installation

31 JAN 1963

MEMORANDUM FOR: Chief, CIA Automatic Data Processing Staff

SUBJECT : ORD Index System Proposal

REFERENCE : Memo to D/S fr C/ADPS, dtd 28 Jan 63, Same Subject

This Office concurs in the content of the reference and attachment which sets forth basic concepts and an implementation schedule for conversion of the ORD/OS Index. The concurrence is predicated upon the provision that personnel, equipment, space, and funds needed to carry out the proposed index conversion program are supplied by ADPS or DDS. This is necessary as present assets of the Office of Security are required for current OS/Operations.

SIGNED

Sheffield Edwards
Director of Security

Attachment

Distribution:
Orig. & 1 - Adse.
1 - ES/OS
1 - Chrono

25X1A

ES/OS: [redacted] :ttc (25 Jan 63 - X6840)

SUBJ: ADP Study of the Office of Security

to perform automatic message switching is presently under study.)

b. OS, as indicated earlier, because of its critical need for swift and accurate name checking; its plan to reduce case processing time; and, also, for its ultimate desire to tighten and improve the total security process.

c. LOG, because of its recognized dependence on machine controlled inventories for improving financial management over the procurement and distribution of materiel.

3. ADP efforts within the DD/S can be accelerated by removing the artificial constraints imposed when the 501 was transferred to the Comptroller. ADPD continues to have an operating responsibility for current DD/S applications. ADPS, on the other hand, is charged with introducing changes to these as well as introducing new ones. The gray area in between has caused confusion among DD/S users and planners (cf. my memo to you dated 6 November 1962, subject: ADPS Relationship to the 501).

[redacted] 25X1A

Joseph Becker
Chief
CIA Automatic Data Processing Staff

Attachments:
1. Memo for D/S dtd 25 Jan 63
2. ADP Study of OS dtd 26 Nov 62

cc: D/S

25 January 1963

MEMORANDUM FOR: Director of Security

SUBJECT : SRD Index System Proposal

1. Last February we agreed to continue mutual exploration of EDP potential in the Office of Security. Accordingly, a team composed of Messrs. [redacted] 25X1A 25X1A has been actively at work; they have received technical help from Mr. [redacted] of IBM, and 25X1A guidance from Mr. [redacted], ADPS. 25X1A

2. Attached hereto is an initial report of Phase II, EDP Study for the Office of Security. In it you will find details of the SRD Index System briefing presented to you and your staff on 19 October 1962. The heart of this report is the recommendation that the present 3 x 5 index cards be converted to IBM punched cards. Implementation of any future automatic data processing program will hinge on having the basic data in machine language. Conversion to punched cards, therefore, represents an essential first step in this process. No specific recommendation for a computer system is made at this time. However, as our experience and readiness grows we anticipate moving in this direction.

3. My recommendations are, therefore, limited to work which needs to be done during the next 12 months in order to convert the index to a punched card file. This work may be categorized as follows:

a. Finalize the design of an IBM index card. The card example included in the report is a draft suggestion based on an analysis of the kinds of data currently being recorded in the manual index.

Precise specifications need to be determined for:

1) data items necessary in the index card,

2) number of card columns required for each data item,

3) most desirable arrangement for printing data at top of card,

4) editing procedures,

5) standard abbreviations or codes,

6) key punch and verification instructions.

During the resolution of the above details, provision will be made for compatibility insofar as practicable with the computer system of DDP/RI. Pending Office of Security proposals to adopt a new all numerical file numbering system for OS should also be resolved concurrently.

b. Perform a pilot operation to convert a portion of the present index to punched cards. The conversion of the total index file to punched cards will be a major undertaking. A pilot operation involving approximately 15,000 cards, is required in advance of this major effort in order to prove the suitability of the card design and the associated conversion procedures. This pilot operation can be accomplished with present OS and ADPS personnel and equipment.

c. Upon satisfactory completion of the pilot operation, convert the entire index to punched cards. As indicated above, this is a large effort which we will try to complete within nine months after the end of the pilot operation. Editing the manual index cards in preparation for key punching will require 12 editors. Card punching and verifying operations will require approximately 18 key punch

SECRET

operators. A special group of personnel should be established for the duration of the conversion project to handle editing and card punching functions.

d. Utilizing existing Agency computers, continue system development efforts by preparing and testing pilot programs.
Punched cards will provide an opportunity for some automatic processing by means of conventional punched card processing equipment. For example:

1) Additions to the file may be sorted into alphabetic sequence for filing purposes.

2) Statistical analyses of the additions may be prepared by overt or covert classification, subject or reference type, and any other classifying data that is contained in the punched card.

3) The main index file may be sequence checked on a cyclical basis to correct manual filing errors.

4) The index may be listed to permit auditing or review of indexed data.

However, the most important aspect of implementing these processes is the useful experience that will be gained by OS and ADPS personnel in the establishment of more sophisticated computer processing systems. ADPS will be utilizing existing Agency computers during the file conversion period to develop and test the necessary programs for such systems.

4. The attached report shows an estimated cost of $92,000 for converting the present index to punched cards. Approximately $8,000 would be for machine rentals and $84,000 for personnel. In addition, there would be supply costs of approximately $7,000 for file trays and cards. You will recall that in our discussion with the DD/S last year, it was agreed that ADPS would budget for

the spade-work. Accordingly, we are prepared to assume costs of equipment and supplies ($15,000) and also to allocate up to $75,000 for personnel costs.

5. I am convinced that the program as recommended is a sound and logical one for the Office of Security. Your concurrence and endorsement are requested. I hope you will:

a. Concur in the concept of the basic program as outlined above and in the attached report.

b. Support the one-year conversion and computer development efforts.

c. Endorse continued ADP Staff efforts to extend the use of automatic data processing techniques in OS.

6. If you concur in this paper, I plan to see the DD/S for his general approval, and for his assistance in resolving implementation problems re people, budget, and space.

[redacted] 25X1A

Joseph Becker
Chief,
CIA Automatic Data Processing Staff

Attachment: SRD Index System

25X1A

CONCURRENCE: [redacted]

Sheffield Edwards
Director of Security

1/31/63
Date

Distribution:
Orig & 1 - C/ADPS w/att.
2 - D/S w/att.
1 - C/SRD w/att.
2 - DD/S w/att.

SECRET

SRD INDEX SYSTEM

prepared by

Electronic Data Processing

Office of Security Team

26 November 1962

Prepared by:

25X1A [redacted] ADPS
IBM
- OS

SRD INDEX SYSTEM

Table of Contents

Approved For Release 2000/05/31 : CIA-RDP83B00823R000100060002-9

SRD INDEX SYSTEM

A. Introduction

1. With the completion of the preliminary EDP Study of the Office of Security (Phase I), the Deputy Director, Support, authorized on 17 February 1962 the Phase II of the Security study providing that any action taken would be compatible with the objectives and aims of the overall DD/S automatic data processing program. On 23 March 1962, the Director of Security announced the study would be undertaken by a team composed of a security representative, an ADP Staff representative and a consultant from a commercial organization. In early May 1962, an IBM representative completed the team and Phase II of the study commenced. Impetus to the Study Team efforts was accelerated with the assignment of another IBM representative in September 1962.

2. The major applications for study by the EDP/OS Study Team involve the index, Special Clearance Center, case control, information retrieval file, file locator and statistical reporting. Other areas will include eventually the National Agency Check system, the liaison clearance program, the badge system and other related systems. This report is a partial study of the Security Records Division as it relates principally to the index system and does not consider in any great detail other areas of the same Division. The primary purpose is to recommend action now for converting the index to machine language. This will eliminate the needless retyping of 3 x 5 cards later and will also establish a machine-based data processing activity that will be compatible with an overall DDS system.

FY 1962

CONTST CASES CLOSED (App & DL's)	-	17,763
EE CASES	-	4,729
AE "	-	1,067
CP "	-	2,666
TC "	-	688
ADMIN	-	1,499
MISC	-	982
OTHER APPL CASES	-	1,940
		31,234
APPLICANT CASES	-	3,159
		34,393

Approx 9% APPL CASES

3. The preliminary Study (Phase I) pointed out the need for automation in the Office of Security particularly in SRD. The heart of SRD is the Indices Section where some delays are caused by the index lookup which is done manually and is dependent on the speed and efficiency of the employee. The increasingly heavy work-load handled by the section has caused the elimination of certain name checks previously made.

25X1A [redacted]

month. The current manual system is not static and because of this growth factor, the need for automation is greater in terms of time, accuracy, growth, space, personnel and efficiency. The processing time now is computed on only a small percentage of the cases which is not realistic from a statistical or an operational point of view. Emphasis has been placed on the processing of T/O cases with the other cases being processed in descending order of priority depending on the nature of the case. For the Fiscal Year 1962, the overall processing time for 3,159 closed T/O cases averaged 91 days in the Office of Security. This is approximately 9% of the overall number of cases closed requiring clearance type action for this period and for which there is no official processing time counted. In the last four months, the average T/O case processing time has been reduced to 81 days based on 1338 cases.

(See opposite page)

(July - Aug - Sept - Oct 1962)

5. Figure 1 sets forth the overall OS Statistics for the Office of Security for the Fiscal Year 1962 and the number of indices checks handled by the Indices Section for the last half of Fiscal Year 1962. The latter figures include written and telephonic requests for checks

as well as checks for records from other Government agencies and requests for liaison clearances by these same agencies for the purpose of carrying on intelligence activities with CIA.

6. This paper will discuss the present SRD system, the possible alternate systems giving advantages and disadvantages of each system, and the index conversion.

Next 2 Page(s) In Document Exempt

(32"x51" - 13 TIERS - 2' LONG)

2. Equipment - The Indices Section is utilizing 45 Rolldex cabinets, each of which is approximately 32" deep and 51" wide, containing 13 drawers with each drawer approximately 2' long and holding 3 x 5 cards. There is no ADP equipment in the section and the entire operation is a manual system.

3. Operations

a. The 44 Rolldex cabinets used in the main index are divided into ten stations with 14 employees assigned to the various stations to handle the searches and filing of cards. A consolidation program has been underway for some time which requires the editing and retyping of the flimsies of the overt type to the 3 x 5 hard card and the letter "M" has almost been reached. No covert type cards need to be retyped since they are already on the hard 3 x 5 card. In this consolidation program, two employees screen approximately 1000 cards per day, two hours of which one of these two employees prepares, separates and bundles flimsies for transmission to the pool for retyping. The other one spends approximately two hours per day checking the retyped cards returned from the pool. At this rate, the program will be completed in about 18 months.

b. Two Indices Section employees spend full time typing reference index cards from various sources for inclusion into the indices. The fields on the card consist primarily of name, reference file number, source document, date and page. On occasion a terse characterization of the nature of the information from the source document is typed on the card. Index cards are also prepared by the Processing Section, SRD, (subject cards) and other offices in Security, namely, the Security Research Staff and the Clearance Branch/PSD (reference cards). Two employees type up the search sheets containing the names to be searched based on the nature of the case. For April, May and June 1962, the number of search

BASIC - AUTHORIZED T/O

1	GS-9	$6,675
1	GS-7	5,540
1	GS-6	5,035
4	GS-5	19,260
19	GS-4	78,090
		$ 113,600

21 UNPL

from SRD RECORDS

sheets typed was 698, 786, and 766 respectively. The remaining employees serve either in a supervisory capacity or handle the administrative phases in the processing of cases.

4. Personnel and Costs - The Indices Section has a total authorized strength of 26 employees broken down into the following grades:

1	GS-9	4	GS-5
1	GS-7	19	GS-4
1	GS-6		

Based on the newly enacted pay bill, total salaries at the basic level in each grade amounts to a payroll of approximately $113,600 (see attached page) per year not including any in-grades that have accrued to some of the older employees. To accelerate the consolidation program and to maintain the current work-load of carding and the filing of cards, overtime has been authorized on Saturdays to handle this operation. Personnel are drawn primarily from the Indices Section with support at times furnished by other sections. For the period January - October 1962, approximately 1000 hours of overtime on Saturdays was authorized to handle the work of the Indices Section. Based on a GS-4 rating (step 1) at $1.95 an hour before the enactment of the new pay raise, overtime pay amounted to approximately $3000. It is recognized that although the authorized strength is quoted above, the Indices Section has been unable to maintain this strength and is usually understaffed.

5. Growth

a. The Indices Section is housed in an area of 2,125 square feet, 825 of which is devoted to twenty desks and the remaining 1300 square feet occupied by 44 Rolldex cabinets and several other minor holdings in a 45th cabinet. Each cabinet holds approximately 30,000 cards (25 linear feet at 1200 cards per foot). The 44 cabinets should, therefore, hold about

1,320,000 cards, which is 280,000 less than the 1.6 million estimated holdings. This difference is accounted for by virtue of the overt "flimsy" type cards (from L-Z) that have not been retyped yet in the consolidation program. When these have all been retyped on regular cards (and assuming no purging), about 10 more cabinets (280,000/30,000) will be required. These cabinets will require an additional 300 square feet.

30 sq ft/ CABINET

b. OS statistics reflect the following yearly additions to the index:

1959 - - - - - - -	108,122
1960 - - - - - - -	149,286
1961 - - - - - - -	168,577

Additions increasing at approximately 10% each year (currently averaging 12,000 cards per month) will require approximately five additional cabinets yearly for the next few years.

144,000/30,000 = 5 CABINETS

DENSITY— 3 X 5 CARDS

NORMAL- APPROX - 1000 CARDS/FT OR 2000/TRAY

MAX - 1200 CARDS/FT.

IBM CARDS

NORMAL - 1500 CARDS/FT.

MAX - 1800 CARDS/FT.

PROPOSED MODIFICATION - 44 ROLLDEX (10 TRAYS)

& 3000/TRAY - 30,000/ROLLDEX

C. Alternative Systems

1. EAM System

a. General

1) The most basic machine-type approach to the indices system would entail the use of an IBM card as an index record. Information now recorded on 3 x 5 index cards would instead be punched into standard 80-column IBM cards, and a printout of the same data as is punched in the card obtained along the upper edge of the card for visual interpretation.

2) The use of the punched card would necessitate defining specific columns (fields) of the card for the recording of individual items of information (e.g., name, date of birth, file number, etc.) All new additions to the index would be restricted as to content by the established format. All existing 3 x 5 records would be converted to the new card system. Details of the card content and conversion are covered in the conversion section.

3) The system envisioned is very similar to that in effect at the U. S. Army Counterintelligence Records Facility at Fort Holabird, Maryland. At this installation, a name index containing approximately nine million cards is maintained on IBM punched cards. 1.8 CARDS PER FILE One purpose for maintaining the index in this manner is to provide a means for alphabetically sequencing the cards periodically by machine methods in order to insure an accurately sorted index, thereby increasing the efficiency and accuracy of index searching.

4) As in all automated systems, the creation of a machine-readable unit record necessitates stringent controls in regard to input data. All information to be transcribed from the existing index cards

EAM EQUIPMENT

3 CARD PUNCH – TO CREATE INDEX CARDS
2 VERIFIERS – TO CHECK PUNCHING ACCURACY
1 INTERPRETER – TO PRINT PUNCHED CARDS
1 SORTER – SEQUENCE ADDITIONS TO INDICES
1 COLLATOR – TO PROVIDE SEQUENCE CHECKING
1 ALPHABETICAL ACCOUNTING MACHINE – REPORTS

9

must be edited carefully, and certain data coded by responsible personnel to insure correct recording in the unit record to be created. All coding should be in accordance with carefully enumerated procedures to insure uniformity, and to guard against the loss of valuable information. To further assure accuracy, newly created records should be machine verified, thereby checking against incorrect information being punched in the card.

b. Equipment - An EAM System would consist of 3 Card Punch Machines to create the index cards, 2 Verifiers to check punching accuracy, an Interpreter to print the punched cards, a Sorter which can sequence additions to the indices, a Collator to provide continuous sequence checking, and an Alphabetical Accounting Machine to provide selective printouts of the indices, or management reports. Approximately 400 square feet of floor space would be required for this equipment.

c. Operations - The flow chart, Attachment B, illustrates how an EAM System would assist SRD indices in the processing of data. Once conversion to IBM cards has taken place, i.e., the present 3 x 5 card holdings have all been transcribed to machine-readable punched card records, the following procedures would be instituted:

1) All new additions to the index will be in the form of punched cards created from source documents. Records will be punched and verified using three standard Alphabetic Card Punch Machines and two Verifiers. Coding of the source data, where required, will be the responsibility of a coding clerk. The punched information will then be printed on two lines of the card by the Interpreter. Name and file number will be printed along the upper edge of the card, the remaining information on a second line below.

INTERPRETS UP TO 60 CHARACTERS ON FIRST LINE

2) Cards to be inserted in the index will be batched at scheduled intervals, and sorted alphabetically on the Sorter. The cards then will be given to indices clerks for manual insertion in the index.

3) The Sorter may be used for the selective retrieval of

coded information from predetermined portions of the index. While a Sorter does have the capability of searching the entire index of 1.6 million cards for a given single coded character in the record in approximately 26 hours, it is not envisioned that this type of application would frequently be demanded.

4) The Collator will be used to sequence check on a continuing basis the existing index cards to insure accurate maintenance of indices.

5) In addition to providing a means for recording information in machine-readable form and maintaining the accuracy of the index arrangement, the utilization of EAM equipment would facilitate the implementation of an effective case control system (See Attachment B). The system would provide a machine means for the control of both overt and covert case flow within SRD, as well as throughout the Office of Security. The system requires the creation of a set of control cards which are key-punched upon initiation of a case, and which follow the case while it passes through various stages of processing. The maintenance of the master control card at a central location permits immediate determination of the location of a case, and highlights cases which have exceeded scheduled norms in processing. This capability was recently demonstrated when listings and cards were furnished SRD, ID and PSD from the overt case master IBM card file. The same control card will be used to provide analytical statistical reports which will provide accurate information concerning open, closed and pending case status; and to highlight information relative to processing times in various OS Divisions. To provide a printout and tabulating capability, a machine tabulator such as the IBM 407, may be provided.

6) Periodic printouts of the case control card file can provide management with valuable reports regarding effective use of personnel, production bottlenecks, workload cycling, and cost factors involved in case processing. Prior to the installation of an EAM System, appropriate division and branch personnel involved with case data flow would be consulted to determine current reporting requirements and the clerical operations needed to support them, and to ascertain what other reports, not now obtainable under a manual system, would be desirable and obtainable with an EAM System.

d. Personnel - Other than personnel now involved in indices processing, two additional persons would be required for verifying punched cards, and an additional two to operate the Interpreter, Sorter, Alphabetical Accounting Machine and Collator.

e. Cost - The hardware costs for maintaining a system as herein described may be broken down approximately as follows:

	Monthly Lease Charge
3 Card Punch Machines @ $40	$120
2 Verifiers @ $50	100
1 Sorter	110
1 Collator	245
1 Interpreter	100
1 Alphabetical Accounting Machine	800

25X1A

[redacted]

the need to sight verify and hand sort [illegible]

f. Advantages of an EAM System

1) The principal advantage that would accrue from the implementation of an EAM System is improved accuracy in the creation of input to the index and in its continuing maintenance. All newly created records for insertion in the index will be subjected to machine verification, a more efficient and accurate edit of data than now is possible through a visual edit of the data recorded on the card. In addition, machine collating of the entire index on a continuing basis will insure proper sequencing at all times, and should substantially reduce occurrences of inaccurate index checking occasioned by misfiling and other human error.

2) Although 80-column punched cards are longer and wider than the cards currently being used (7 3/8 x 3 1/4 inches, as compared to 3 x 5 inches), an index composed entirely of punched cards would require less floor space than now is being utilized due to the lighter stock which would be used.

3) Having the index maintained in a machine record form would permit selective sorting and printouts of predetermined portions of the index on a special request basis. For example, present or potential users of the system may request a listing of a limited section of the alphabet in an effort to establish the identity of an individual regarding whom limited information is available.

4) A potentially important advantage to be gained from the implementation of an EAM System is that it would facilitate the conversion to a computer system at a future date should developments warrant. It is conceivable that should indices continue to experience its current rate of growth, any system short of one which is computer oriented will fail

to achieve production objectives. Should this condition evolve at a later date, and if a machine record index is not now established, it is certain that conversion to a machine language acceptable to a computer system will prove far more complicated and costly.

5) Using EAM equipment would facilitate the introduction of an inter-agency mechanized communications system for the servicing of NAC's. A feasible approach to such a system would entail the use of transceiver equipment such as that currently installed at Ft. Holabird, in which the punched card is used as a carrier for the data being transmitted from one installation to another. Since the outlined EAM System would closely parallel the Ft. Holabird installation, the initiation of an inter-agency arrangement for mechanized name checks between at least these two agencies would not be difficult, should a mutually agreeable policy be adopted. This system could also serve as a pilot project for the possible extension to other agencies.

6) The use of a punched card allows pre-sorting of additions to the index (currently 12,000 per month) at machine speeds. This should assist in more rapid insertion of additions to the index and reduce processing time.

7) An EAM System can be applied to an effective case control and statistical reporting system, insuring accurate case status reporting and providing managers with meaningful statistical reports concerning workloads, times involved in processing, and utilization of personnel.

8) Using punched cards in place of search request sheets permits simultaneous name checks of all names in a given request.

9) Listings of sequential portions of the index may be made, permitting editing and purging of duplicate and/or redundant cards.

10) A duplicate set of cards can be easily generated and maintained at the Records Center for use in an all-out emergency in the event of an evacuation.

g. Disadvantages

1) The primary disadvantage of adopting an EAM System is the cost of converting from the present completely manual system. (A discussion of the cost factors will be found in the conversion section of this report.)

2) Additional personnel would be required to establish and maintain an EAM System. The additional personnel not offset by the elimination of other operations would consist primarily of two persons involved in verifying the punched data, and two additional machine operators. However, these increased costs for personnel would insure a degree of accuracy in the creation and retrieval of records which cannot be attained readily in a manual system.

3) The creation of a machine record such as the punched card would necessarily restrict the amount of information which can now be recorded in the index. Some of the information now contained in the index may be eliminated through conversion. More stringent restrictions and limitations as to content and format would be imposed by the use of the punched card as opposed to the relative recording freedom now enjoyed through the use of the 3 x 5 card.

TAPE SYSTEM

CARD READER
HIGH SPEED PRINTER
4 TAPE DRIVES
CENTRAL PROCESSING UNIT
8,000 POSITIONS OF CORE MEMORY

1401 — 800 sq. ft.
COMPUTER COMPONENTS CAN BE
COMPACTLY ARRANGED.

PRINTING CARD PUNCH MACHINES } EACH
VERIFIER } 31 1/2" sq ft

SORTER 63" X 20"

2. Magnetic Tape System

a. General - Because of the frequent need for immediate access to the indices, a tape computer system in which the indices are recorded only on magnetic tape is not feasible. The magnitude of the index precludes the possibility of retrieving specific records within the time limitations imposed by the necessity for immediate access. However, a tape computer system enhanced by the existence of an IBM card index to which infrequent, yet necessary, immediate inquiries can be made, would be a realistic approach to the indices application.

b. Equipment

1) In determining the feasibility of solving the indices problem through the use of a tape computer, the IBM 1401 Data Processing System is used as a frame of reference. The necessity to consider such items as exact tape speeds and data transmission rates, tape file arrangements, cost, and the availability of specific items of hardware, makes reference to an existing computer system advisable. In this section of the study, considerations are confined also to readily available computer hardware without regard to specially designed items.

2) A possible tape system configuration would include a central processing unit, 8,000 positions of core memory, a card reader-punch, a high speed printer, and four tape drives. Applications other than those in SRD might justify expansion of the system to provide greater internal storage capacity, additional tape drives or to include disk files of one type or another.

3) An IBM 1401 Data Processing System requires relatively little space. The actual floor area needed is approximately 800 square feet, and computer components can be compactly arranged. Additional

space may be allocated for Printing Card Punch machines and Verifiers (each requiring 31" x 28" of floor space), and a Sorter (63" x 20").

c. Operations

1) The success of tape searching may to a large extent depend upon the method which is devised for arranging the entire index on tape. Another important consideration will be the method which is devised for the handling of name variants, highly significant in considering name searching in a security index.

2) Exact techniques that would be employed in processing searches against the index have not as yet been decided. Instead, the approach has been to determine if transforming the indices into a magnetic tape file which could be processed sequentially would prove feasible. It is believed indices searching can be accomplished in a more efficient manner than is possible with a manual procedure. It is also felt a tape system could effectively process batched searches against the index at speeds which would substantially reduce the time now required for processing these searches through the Indices Section.

3) After conversion to the unit record card is completed, the entire index would be transcribed to magnetic tape. Additions, as needed, would be made to both the tape file and card file; changes and deletions would also be effected in both places. However, for file maintenance, only one set of input data need be created, i.e., cards used to update the tape file can be subsequently used as a permanent form of input to the manual file. The format of a tape record which might be designed for the system is indicated in Figure 2. For the system described, the design of the tape record is dependent upon the manual system which will be used to provide a visual file for immediate

LAST NAME, FIRST	FILE NUMBER	TYPE OF CASE	INFO CODE	D.O.B.	P.O.B.	SEX	RETIRED	RESIDENCE	SOURCE INFORMATION
1- -29	30- -36	37-38	39-40	41-46	47-58	59	60	61-67	68-79

AKA, PHYSICAL CHARACTERISTICS, MISCELLANEOUS INFORMATION	
80 INDEFINITE	

TAPE RECORD LAYOUT

FIGURE 2

access. The definition and format of various individual fields is largely a result of the consideration that the card file which forms the basis for the tape file must be used as a visual source. The card record has been purposely designed to contain the information in a single card, wherever possible, restricting severely the use of trailer or second-part cards. No intention exists to limit the size of the tape record severely; rather, the primary thought was to cut down as much as possible the physical space needed to contain the manual file.

4) The manual file will exist for the main purpose of providing a means to service immediate search requirements. Because of the more expeditious service that would be furnished by SRD with the computer operated system, it may be anticipated that such requests will be reduced to a number considerably less than now experienced. Consequently, the visual index may be stored in a vertical file arrangement requiring far less floor space (approximately 10% of current area being used - 130 sq. ft.), and permitting servicing by one clerk who would be responsible also for maintenance of the index. The interfiling of 700 index cards, the daily input, would take approximately two hours per day.

Space Requirement - 130 sq ft

700 INDEX CARD - 2 HRS/da

5) Attachment C contains a representation of the general processing flow using a tape system. Under the envisioned system, all names to be searched, including subjects and references, will be indicated concurrently on the source document. Search cards with the names of all individuals to be searched against the master index are prepared from the same document. Search cards on subjects can serve a dual purpose, i.e., they may also be used effectively for case control

processing and/or for statistical analysis reporting. Since the processing time in indices would be measured in hours rather than days, it would not be necessary for names pertaining to an individual case to be searched at separate stages of the processing through SRD.

6) The most significant element of the system would be the manner in which names would be searched against the master index. One possible approach is described, although a tape system, if adopted, may differ in its final version.

a) Because of the immensity of the master index, and the comparatively small number of searches made against it, a straight serial approach cannot be considered the most efficient. However, using a tape file arrangement, an advantage may be gained by distributing the index in a more favorable arrangement over a number of tapes, rather than packing the index as tightly as possible on a minimum of tapes. This would serve to reduce the number of records in the master index that need be read from a maximum of almost all the index, if a packed arrangement were used, to a lesser number if equal distribution of the index were made over a greater number of tapes. In this manner, the search program can continually test to determine whether remaining tape segments may be ignored, or even whole tapes by-passed in the processing. This would, in effect, simulate random searching to an extent and minimize the disadvantage of serial processing. With proper operator planning, much of the set-up time and tape handling involved could be overlapped by machine processing.

b) It is estimated that the amount of computer time required to handle the daily volume of index searches would be one to two hours. The actual time will depend upon the number of runs per day, the extent of name variant sophistication applied, and the type of equipment

PERSONNEL REQUIRED

1 file clerk and searcher
5 key punch operators
1 code clerk & editor
1 clerical supervisor

used. Additions, deletions and changes to the index on a daily basis would require about 30 minutes additional computer time per day. 30 MIN.

c) Time-saving advantages can be gained from "batching" the input to the search run. The advantage of "batching" must be weighed carefully against the operational desirability of improving SRD throughput processing times as much as possible. A preliminary examination of the problem indicates that either 1/2 day or 1 day searching cycles appear to be the most logical possibilities.

d. Personnel

1) Based on current workloads, the proposed tape system would enable considerable personnel savings in the Indices Section. In place of the Indices personnel now required to do searches, and to maintain the master index, it is estimated that the following would be required:

a) 1 file clerk and searcher - responsible for providing immediate index searches as requests occur, and for filing 12,000 monthly additions to index (2 hours per day filing time), and also for processing manual deletions and changes in the index . 1

b) 5 key punch operators - responsible for punching and verifying approximately 10,000 search requests per week, and preparing new cards for filing. 5

c) 1 code clerk and editor - screens and codes source documents, and provides data to key punch operators in final key-punching format (concerned only with records affecting master index) 1

d) 1 clerical supervisor - insures proper distribution of workloads and continuous processing. 1

2) In addition to the personnel enumerated above who would be employed directly in SRD, additional personnel costs would be reflected

PERSONNEL REQUIRED COMPUTER

3 SYSTEMS ANALYSTS

4-5 PROGRAMMERS

2 CONSOLE OPERATORS

SUPERVISORY & MGMT PERSONNEL

in the staff required to maintain the computer installation. This might include as many as 3 systems analysts, 4 or 5 programmers, 2 console operators, and additional supervisory and management personnel. However, this staff would be engaged in the overall planning, programming, and execution of computer applications throughout the Office of Security (or possibly a wider area), and only a portion of their costs can be attributable to SRD generally, and a smaller amount to indices specifically.

e. Computer Costs - Rental costs for a tape computer system of the size required to process efficiently SRD Indices searches would be approximately $7,500 - $10,000 per month. Realistically, only a portion of this cost should be chargeable to the indices application, since the cited leasing charge is for a full shift's (176 hours per month) use of the system, and only about 15 - 30% of this time would be used in this phase of the processing. Therefore, computer costs for indices searching would range from $1125 - $3000 per month, if the remainder of machine time can be charged to other applications.

Related equipment costs would include the following:

Number	Item	Monthly Lease
3	Key-punch Machines @ $40	$120
2	Verifiers @ $50	100
1	Sorter	125
1	Interpreter	100

The costs of these items of equipment also may be offset by additional use in other applications areas.

f. Advantages of a Tape Computer System with Card Backup for SRD:

1) Indices searching by machine methods could produce a

significant reduction of case processing time through SRD.

2) One-day or less service on all name index searches could be provided requestors on a routine basis.

3) Service in a day or less would eliminate the multiple-priority system now in effect and reduce requests for immediate searches.

4) An IBM card back-up index would always be available for immediate access and for verification of searches.

5) Use of a tape record could provide a capability for selective retrieval of information.

6) Print-out of results of searches would provide hard-copy verification that search had been made, and would indicate exact information searched.

7) Use of tape would allow selective recreation of special files of interest to users, e.g., personnel profile characteristics file, modus operandi files, organizations file, file of Chinese Ming numbers, etc.

8) There would be a significant reduction of physical space requirements.

9) Additions to file could be machine verified, and data again checked on entry to system to insure high degree of accuracy in recorded data and physical file arrangement.

10) System has unlimited growth potential with minimal increase of size and expense in drastic contrast to a manual system.

11) Techniques developed in implementing such a system could have significant relationships to other CIA data processing problems as well as other agencies' activities.

12) Personnel time saved can be devoted to other essential OS needs such as more complete indexing and more comprehensive case analysis.

g. Disadvantages:

1) Necessitates maintenance of duplicate index: card and tape.

2) Initial one-time conversion cost is high.

3) Until cut-over to new system is effected, duplication of effort will result in interim increased costs.

4) Retraining of personnel necessitated.

5) Implementation of system will result initially in disruption and imbalance of workload and work flow among SRD branches, requiring period of adjustment.

1301 —

1 MODULE — 50,000,000 CHARACTERS
(2 disk ARRAYS ≡≡)

1.6M x 80 = 128,000,000

RENTAL — $18,000/yr.

INDEX EVER INCREASING

3. Disk File System

a. Probably the most efficient, though more costly, computer means available for the processing of name searches is a disk file random access system. In this type of system, the master index is arrayed in disk files which may be accessed more directly than in a tape-oriented system. Any given portion of the index, or even particular records, may be addressed directly, i.e., without passing and examining in a serial fashion vast portions of the file, to determine whether specific records exist.

b. This paper does not treat in detail the indices searching application through the use of a disk file system primarily due to cost considerations for such a system. The need to provide a file capacity of over 100 million characters eliminates from consideration the inexpensive disk file devices now available in the computer market. Devices such as the IBM 1301 Disk Storage must be used, necessitating consideration of larger and more expensive basic computers. To be more specific, to store 1.6 million records averaging 80 characters, 3 modules of 1301 Disk Storage devices, each with two disk arrays, would be required, along with an IBM 1410 Data Processing System (the IBM 1401 DPS does not accommodate 1301 Disks). Such a system would rent for approximately $18,000 per month.

c. In addition to all the advantages offered by a tape computer system, a true random access system would permit faster processing of index searches. Perhaps more significantly, a disk file arrangement permits immediate inquiries to the file on a priority interrupt basis, i.e., any machine run may be interrupted temporarily to accept inquiries from a console typewriter and to provide the results of a search on the same device. The machine may be left in a status so that even untrained personnel could

make inquiries to the index on a twenty-four hour basis, without the presence of console operators. Naturally, this capability eliminates the need for a back-up card file.

d. Many of the systems and programming problems associated with disk file arrangements have been solved successfully in designing the

25X1A [redacted] will search a file of over seven million names, partially arranged in IBM 1301 Disk Storage devices, and will provide name variant searches hitherto unavailable under a manual system. [redacted] 25X1A systems personnel already have determined the feasibility of this type of name searching, and much of the systems effort expended in the

25X1A development of the [redacted] system need not be duplicated in instituting a system for the security index.

4. Microfile Systems

a. Several manufacturers have devised systems for the rapid retrieval of information and documents, and some of these systems will be discussed briefly. It is pertinent that these systems be considered for possible adaptations to the indices problem either in their present use or for use with modifications. Three typical systems are:

1) Photographic Information Storage and Retrieval System - This system provides for compact storage of documents, automatic retrieval and the production of a hard copy without disturbing the file. Basically, the unit of storage is a small photographically developed film card that has been keyed in with a document number on a camera coder, stored in capsules and placed in trays for filing in cabinets. The information is retrieved by document number by selecting the appropriate capsule, then keying in on a selector producer, passing the cards from the capsule under a photocell read head until the card matches the document number that was keyed in on a keyboard. The correct card images are projected into a reproduction process which immediately produces copies of the information stored on a card. Approximately 600,000 pages of documents can be filed in three square feet with retrieval time 60 seconds from request to copy. The system is relatively simple and inexpensive, materially reduces space requirements and provides for updating and purging. However, it does not provide for the handling of an index record as an integral part of the system as selection is made only by locator number. This system does not appear to lend itself to the indices problem unless extensive modifications were made.

2) Microfilm Retrieval System - This system is utilized by the New York Telephone Exchange in locating the name and phone number of

a person in about three seconds from a listing of approximately 8,000,000 names. The telephone pages are microfilmed on strips that are filed in cartridges for retrieval. A verbal request is received by one girl sitting at a console who checks the names by selecting the appropriate cartridge which is within reach on the console. The cartridge containing the page on which the person's name is listed is placed in the reader and within seconds the name and number is retrieved. Names to be added to the listings are placed in another area of the console and these names are checked until they are consolidated with the main file. This system provides for the rapid retrieval of names, reduces personnel and space requirements and permits access at all times. The main disadvantages are primarily two-fold: the difficulty of updating the basic record or main file particularly where it is microfilmed; and there is no provision for expansion with other programs that are related to the indices.

25X1A 3) [redacted] is a photographic-electronic system able to retrieve any one of millions of printed or typed pages or photographs from a file center within five seconds.

a) A tiny image of the document is photographically transferred to an IBM card so the document can be viewed on a screen or printed out without removing it from storage. Immediate access to any of the images stored in the bins is faster than locating information which must be searched serially. Information from a magnetic index immediately pinpoints location of the image in the file so that within seconds the document is ready for viewing or photographic reproduction.

25X1A The operation of [redacted] is comparable to that of a library--a dynamic type of library serving users almost instantaneously with information. Its catalog, or index, is a magnetic file. Its "shelves" are bins, each

automatically loaded with photographic images of documents that have been reduced to about 1/1000th of their original area.

b) First, documents are microfilmed. Then the 35-mm microfilm is placed in an image converter, which further optically reduces the image and transfers it to strips of film, each strip containing 99 images. As an image is transferred from microfilm to film strip, control cards are automatically punched to record its location in the file. Each bin, or document file, contains 200 plastic cells of 50 film strips each, a total of 990,000 images. This is roughly equivalent to about 3,000 average-size books. The total [redacted] system can accommodate more than 100 document files. (100 MODULES – SYSTEM NOW HAS 3 MODULES)

25X1A

c) A user starts his search for information by writing key search words on a form--words such as "Smith", "computer", or "creativity". Punched paper tape made from the form is placed in the machine, and a magnetic index is searched electronically. A list of index entries corresponding to the documents found by the key words is printed and returned to the user. The user checks his choices on the list. Punched cards corresponding to the selected documents are pulled from a file of cards prepared when the document or abstract list was printed. From this file, pertinent data such as image location of the desired document and identification of the requestor are automatically punched in an aperture card containing a blank film insert. The unexposed aperture cards are inserted into the document file which reads the location from the punched holes and brings the film strip containing the document image into lens position. The card's film insert with up to four images is automatically exposed by ultraviolet light and developed immediately by a dry heat process in about one-half second for each operation. The card is then returned to

INDEX MACHINE NOT IN SYSTEM AT PRESENT

the user, who may enlarge the images to original document size for printing or for viewing with a projection device.

b. Advantages and Disadvantages of Microfile Systems - Although these type systems generally require less space and personnel and allow rapid conversion as well as a favorable growth potential, there are several major disadvantages. These include:

1) Updating of the index would be time-consuming and complex.

2) The lookup procedures to obtain a file number would generally be rather cumbersome.

3) The initial one-time conversion costs would be as high as, or perhaps higher than IBM card conversion costs.

4) These systems generally tend to be a "closed system" in that it is rather difficult or impossible to relate the data in machine language to other systems (e.g., case control and NAC in the case of the SRD index system)

5) These systems basically are oriented toward page-type documents.

D. Conversion

1. General

a. Regardless of whether SRD Index is destined to be changed to a punched card system, a computer based system, or a micro-image system, conversion from the present 3 x 5 holdings to some form of machine language is necessary. Comparing the general advantages and disadvantages of potential methods of conversion between punched cards, punched paper tape, and microfile approaches, the conversion using punched cards offers the most advantages in terms of total costs, active use during conversion, usefulness as backup, ease of retrievability, updating, handling and relationship to future computer-based systems.

b. The conversion program will have two basic steps:

1) The first will consist of a pilot operation (using about one per cent of the total index) which can be initiated immediately using existing personnel (3 clerk months) and equipment assets. This operation will test ① the validity of the format of the punched card and will also ② provide information concerning the actual editing and coding rates and information as to whether there should be additions or deletions during the editing operation.

15,000 INDEX CARDS

2) The second phase, as a continuation of the first phase, will be the actual conversion of the total holdings of the main SRD Index. It is proposed that this be a one-year program and the discussion below is based on this assumption.

ASSUME TOO 1 YEAR

2. Equipment - As a result of the consolidation program, about 10 additional Rolldex cabinets will be required when the consolidation program is completed based on the fact many of the present flimsy overt

PRESENT CABINETS -	44
GROWTH YEARLY -	5
144,000/30,000	
OVERFLIMSIES	
280,000/30,000	10
TOTAL	59

IBM CARDS

NORMAL - 3000/TRAY
10 TRAYS/CABINET - 30,000
1,660,000/30,000 - 53 ROLLDEX

Approved For Release 2000/05/31 : CIA-RDP83B00823R000100060002-9

cards now being retyped are being prepared on heavier 3 x 5 card stock. Assuming the consolidation program is finished in approximately a year and there is a normal growth of about 10 per cent, SRD will have about 59 cabinets (44 now + 10 for consolidation + 5 for growth). If, however, the same cards were completely transposed to IBM punched cards, the same holdings would require about 55 cabinets, because the IBM cards require 5 to 10 per cent less volume than the present 3 x 5 cards. IBM cards are longer but thinner and will withstand the expected reasonably heavy manual handling.

3. Operations

a. There are four basic methods by which the SRD Index could be converted to a punched card index. The first method is preferred. In any event, the conversion should start at the point of the present consolidation program to save retyping approximately 400,000 cards.

1) Replace the 3 x 5 cards by IBM cards cabinet by cabinet. Start the conversion at the point of the present consolidation program in the alphabet. IBM cards only would be produced after appropriate editing and coding. The IBM cards would be placed alphabetically in a cabinet with appropriate size trays until a cabinet was full of IBM size cards. The duplicate cabinet of 3 x 5 cards used during this period could then be retired or destroyed. The conversion could proceed cabinet by cabinet through the alphabet. At the same time, the new cards would be produced either as 3 x 5 cards (on a standard typewriter) or as IBM cards (on a Model 024 IBM punch and interpreter) depending on what alphabetic part of the index had been converted. As the conversion proceeds,

PREFERRED METHOD — CABINET BY CABINET

TYPEWRITER + PUNCH FOR NEW CARDS

the corresponding portion of the new cards being typed will be produced only as IBM punched cards. The new 3 x 5 cards would be interfiled in the unconverted portion of the index.

2) This method would be very similar to the one described above except that the new cards for all areas of the alphabet would be produced on three Model 826 typewriter/punch machines (3 x 5 and IBM size cards). The 3 x 5 cards would continue to be interfiled throughout the alphabet unaffected by the conversion program. The IBM cards will be laid aside temporarily and interfiled at an appropriate time into the converted index holdings. As the conversion program proceeds, the new IBM cards produced could be inserted in that portion of the alphabet which is being converted.

3) Produce 3 x 5 cards plus IBM cards on a Model IBM 826 typewriter/punch machine. Continue to interfile the 3 x 5 cards thus typed in the present index. Set aside the IBM cards produced until the entire conversion is completed. At the same time, the new cards will be produced also on an 826 in the 3 x 5 and IBM size with the 3 x 5's being interfiled and the IBM cards being stored with the others. When the conversion is completed, the IBM deck could be then substituted for the 3 x 5 cards which could be retired or destroyed. This method would produce the ambiguity inherent in two indices and the requirement to store the second index until completion of the conversion.

4) Punch just the IBM cards on both the conversion and the new card typing operations. The IBM cards would be interfiled into

CONVERSION PROGRAM - 1 YEAR

8 - EDITING + CODING
8 - PUNCHING
4 - VERIFYING

PUNCHING

100 CARDS/HR

VERIFYING

200 CARDS/HR

AV EDITING + CODING RATE - 100 CARDS/HR

MACHINES - 40 SQ FT
(4 MACHINES - 25 SQ FT)

the present file holdings which would require the immediate acquisition of approximately 14 additional Rolldex cabinets to accommodate the interfiling of the longer IBM cards. About 400 additional square feet plus $8,000 for the 14 cabinets will be needed as soon as the conversion program commences. These costs are in addition to the normal conversion costs and additional personnel and equipment costs which will be described later.

4. Personnel, cost and space factors

a. The personnel requirements for the conversion program only will approximate 8 clerk years of editing and coding, 8 clerk years of punching, and 4 clerk years of machine verifying. These figures are based on a standard Government rate of 100 cards punched per hour, name and number machine verification at the rate of 200 cards per hour and an average editing and coding rate of 100 cards per hour.

b. The conversion cost factors include personnel costs of 20 clerk years at $4200 per clerk or $84,000. The machine costs based on 8 punch machines and 4 verifying machines will be $8000, which makes the total $92,000. Offsetting this cost, however, is the possibility of utilizing uncleared employees in the Personnel Office pool which could supply approximately 8 clerks on a continuously rotating basis with each clerk providing about 2 months of punching time until assigned. Arrangements can be made by the ADP Staff for a 3-day training session for the individuals selected. Verifying operators can be supplied on the same basis. Officials in charge of the Pool have indicated necessary space and machine operators can be made available for this program at 16th Street. With this support from the Pool, the Office of Security

could complete the index conversion by providing 8 clerks for editing and coding from its current staff or requesting such additional personnel from the DDS. Another possibility is to have the punching and verifying done on a contract basis by another government agency or a commercial service bureau. This would cost approximately $80 per 1000 cards based on the average commercial service bureau rate.

c. The program for the typing of the cards for new index entries should start concurrently with the conversion and will require 3 IBM Model 024 Punch Machines, 1 Verifying Machine and 1 Interpreter at a total cost of $3240 per year rental. This equipment will occupy about 150 square feet. There will be no significant additional operator cost on this program since three clerks are now typing the 3 x 5 cards. When the conversion is done, this operation will continue to be done in the same manner.

NEW CARDS
3 - PUNCH
1 - VERIFYING
1 - INT

d. The editing and coding for the conversion can be done at the present work stations in the Indices Section. The 8 Punch Machines and 4 Verifiers and 1 Interpreter may be used at 16th Street providing OS permits the Pool to type covert cards. If this is not done, provision for 4 Punch Machines and 2 Verifiers requiring 250 square feet and 6 operators will have to be made within the OS controlled area for the punching and verifying of the covert cards.

Pool
8 PUNCH
4 VERIFIERS
1 INT -
OR
OS
4 PUNCH
2 VERIFIERS
1 INT.
6 OPERATORS

5. Punched card

a. IBM cards have been designed for use as the new index cards in the conversion program (See Figures 3 and 4). The cards contain essential information that can be retrieved manually or converted to magnetic tapes and be retrieved rapidly if a tape-driven system is adopted. For the optimum system, all significant available information should be indexed and punched. The proposed cards will contain the following fields of information:

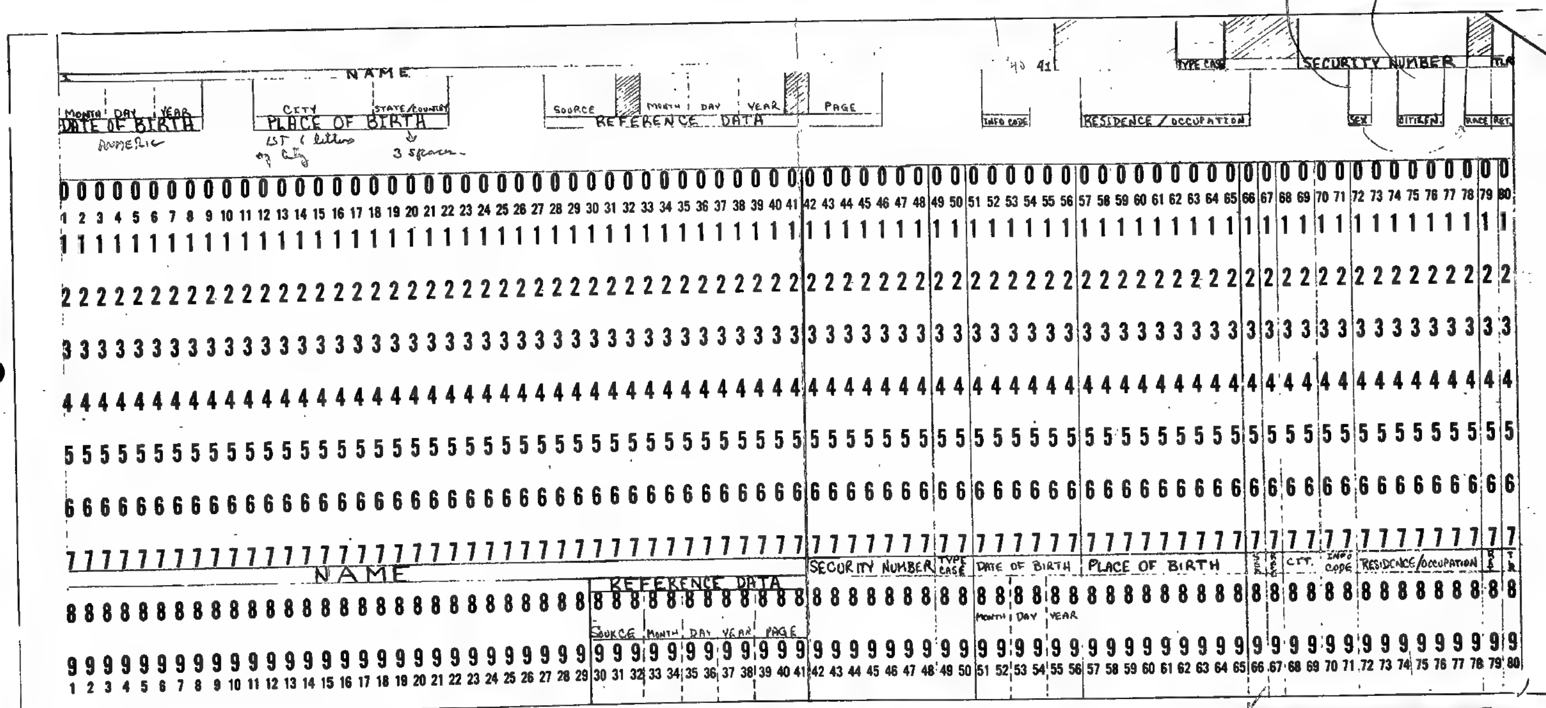
ILLEGIB

ILLEGIB

[redacted]

1-41
1-29

[redacted]



[redacted]

[redacted]

Figure 3 Page 36

ILLEGIB

ILLEGIB

1-20 1ST 20 CHARACTERS OF NAME

21-22 CODED - TYPE OF VARIABLE INFO THAT FOLLOWS - (AKAS, NEE, ETC)

23-79 variable info —

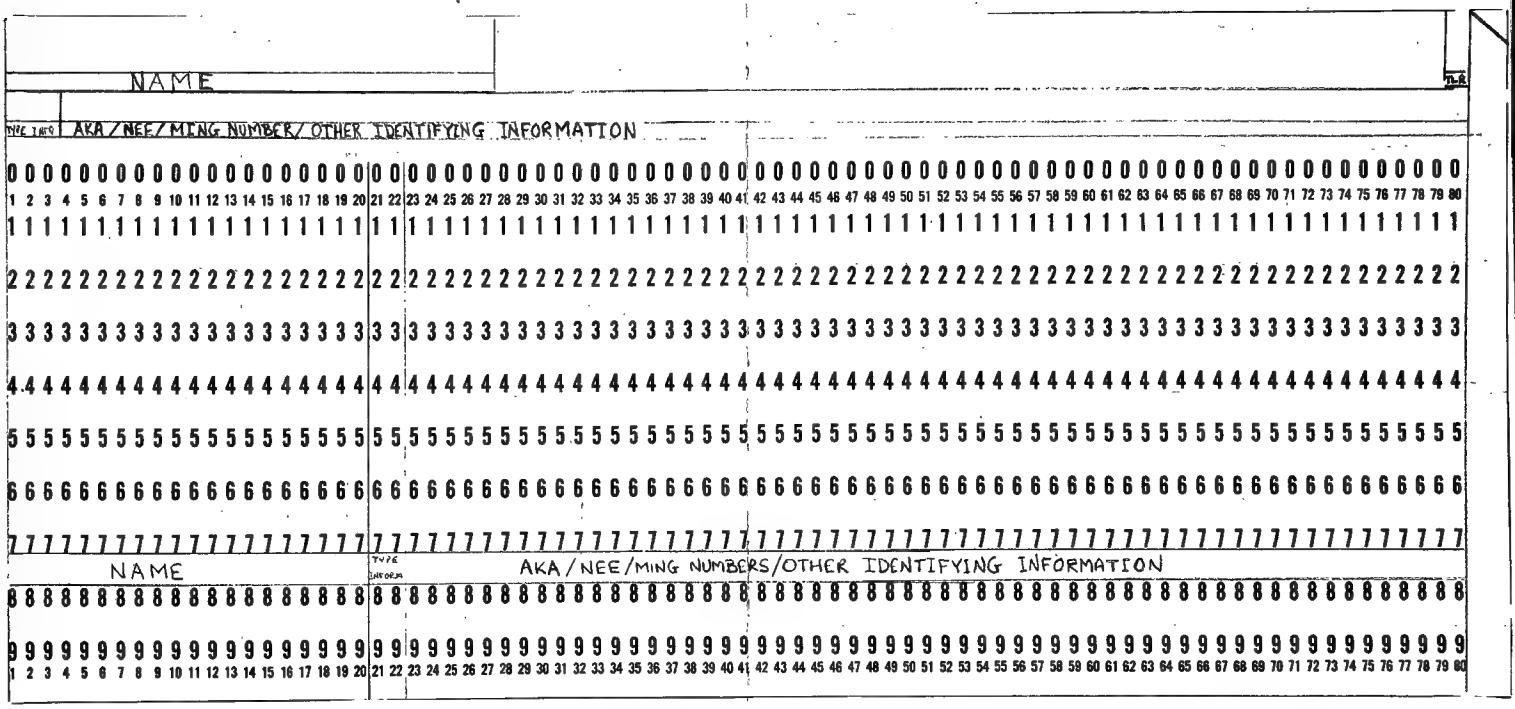


Figure 4 Page 37

1) Master Card (figure 3)

a) Name data - Columns 1 - 41 provide for name data on subject cards. Columns 1 - 29 provide for name data on reference cards. Trailer cards will be used when the name data exceeds the columns just described.

b) Source of information - Columns 30 - 41 are used only on reference cards. This information is divided into three parts: Source (col. 30 - 32), date (col. 33 - 38) and page number (col. 39 - 41).

c) File number - Columns 42 - 48 are used to provide a seven digit number.

d) Type of case and card - Columns 49 - 50 will indicate the nature of card: overt subject, covert subject, overt reference or covert references and sub-catagories under each of these. This information will be coded for use as part of the case control and statistical reporting system.

e) Date of Birth - Columns 51 - 56 will provide for numeric dates.

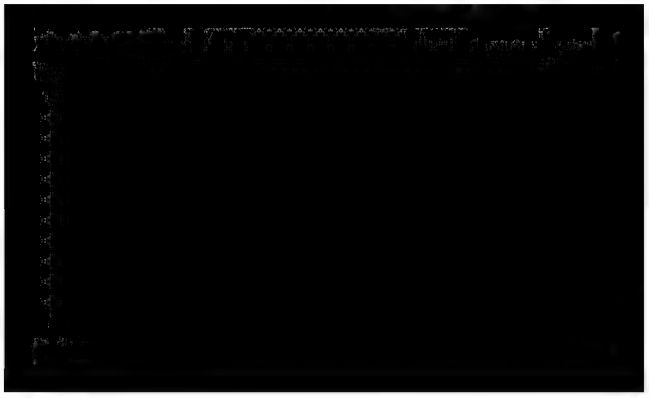
f) Place of Birth - Columns 57 - 65 The first six letters of the city will be typed and the last three spaces will be used for standard abbreviations of states in the U.S. or foreign countries.

g) Sex - Column 66. Used as a spouse indicator. Study of the index disclosed cards with first names unknown which gave the sex of the individual.

h) Race - Column 67.

i) Citizenship - Columns 68 - 69.

ILLEGIB



j) Information code - Columns 70 - 71.

Applies to the reference cards where pertinent information is indicated by code, e.g. if the person is a Communist sympathizer, the numeral 1 would so indicate, an USSR agent, numeral 2, etc., or whatever code would be considered desirable using numerals or letters or combinations. This information is being retained from the present indexed holdings primarily for use in a tape system. Printout of such information would be very useful in the CI-CE areas.

k) Residence or occupation - Columns 72 - 78 will be used to indicate by code the residence or occupation with the residence taking preference if both are indicated with the occupation being put in the variable information field.

l) Retired card - Column 79.

m) Trailer indicator - Column 80.

2) Trailer card (figure 4)

a) Name data - Column 1 - 20 will contain the first 20 characters of the name.

b) Type of trailer information.

Column 21 - 22 will contain, in coded form, the type of variable information that follows. This will include AKA's, nees, pseudo, Ming numbers, physical characteristics and remarks.

c) Variable information - Columns 23 - 79.

d) Further trailer card indicator- Column 80.

b. The IBM card for companies, organizations, publications and others of a similar nature will use the same card. Development of standardized abbreviations will keep many of this group within the field designated. Columns 49 and 50 by use of codes will indicate whether it is an organization, company, etc.

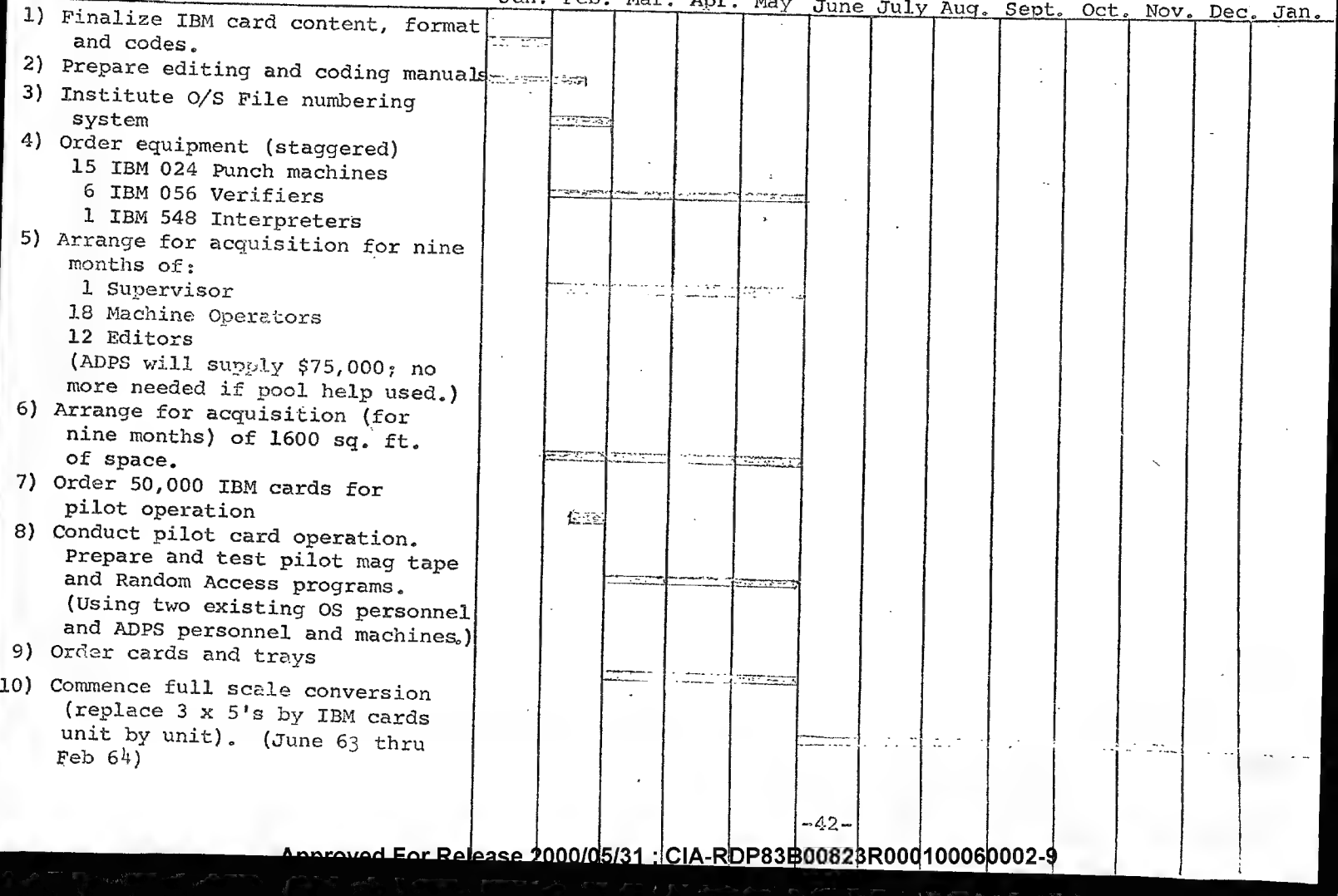
c. The punching of cards in the conversion program should not commence until an all numeric file numbering system is adopted by the Office of Security.

d. The present consolidation program should be merged with the conversion program.

6. The preceding estimates of personnel and machine requirements for the conversion of the complete index (after the pilot operation is finished) were made on the basis of one year. If it is desired to complete the conversion in nine months, certain changes in the number of machines, operators and editors will be required. Under such a schedule, 12 punch operators, 6 verifiers and 12 editors will be required for the nine-month period. The preliminary activities of determining the editing

and coding procedures, obtaining sample cards, performing the pilot operation, ordering the equipment, arranging for personnel and space all will require a carefully followed schedule. If this is done it is estimated that the actual conversion can start approximately three months after the program is initiated. A proposed schedule will be found on page 42.

SRD INDEX CONVERSION SCHEDULE



COMMUNICATIONS

ATTACH A

Clearance Request Time Stamped

CHIEF CLERK

Form 44D Prepared

44D Log Cpy

Held by Date

44D

Covert comeback case?

Yes

Proc. p.2

No

INDICES

1. Date Form 44D-Pull Log Copy File by Name
2. Type Form 1734
3. All-trace Search Made
4. Prepare Necessary Charge-outs

Close out 44D Showing next Routing

44D

Covert comeback case?

Yes

Files to be Pulled?

No

2

p.3

Yes

No

Record on Subj/ Spouse?

No

Yes

FILES

1. Date Form 44D
2. Pull Files Which have Charge Outs Made

Covert comeback case?

Yes

Files on Shelves?

Yes

CAB p.3

No

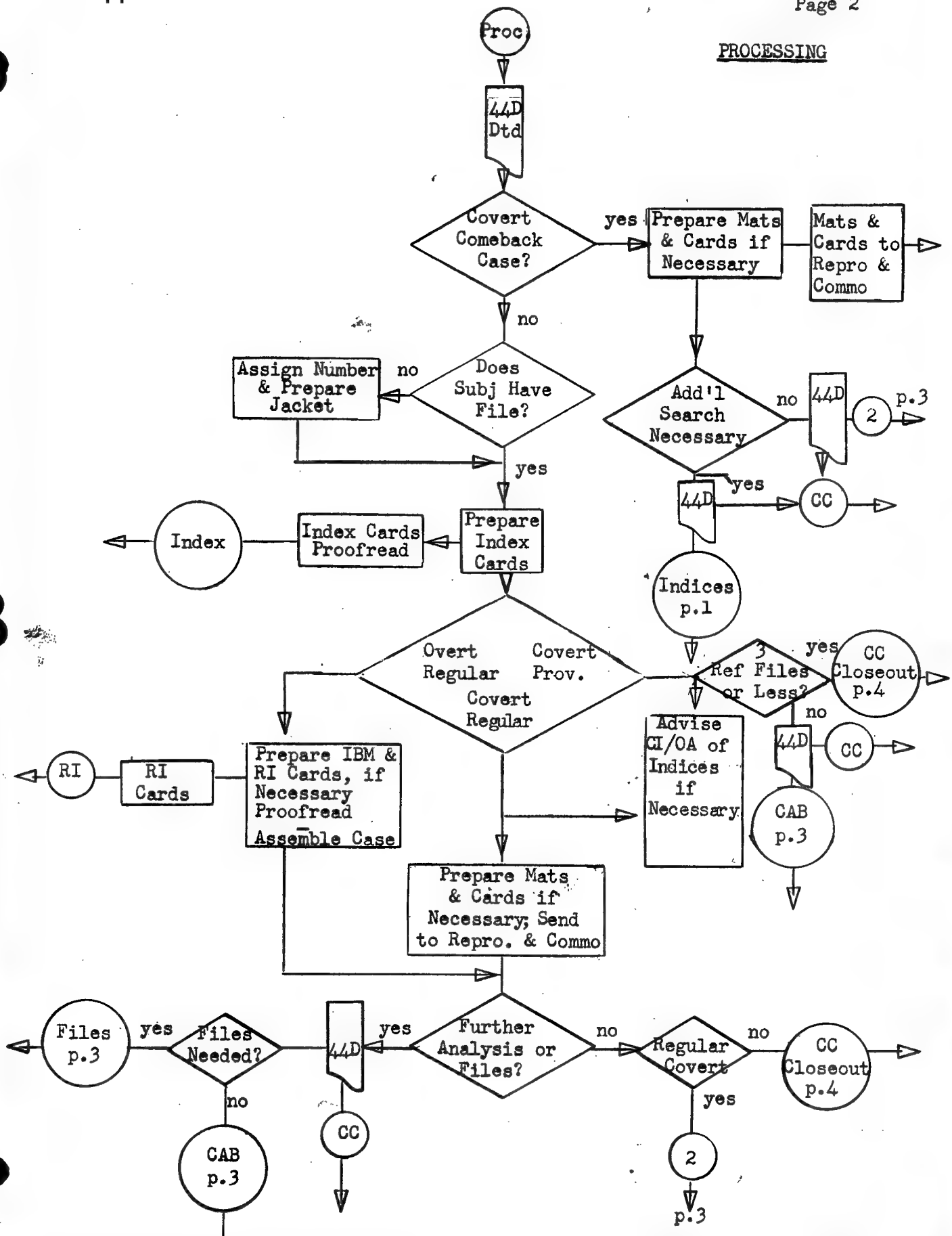
2

p.3

No

Proc. p.2

PROCESSING



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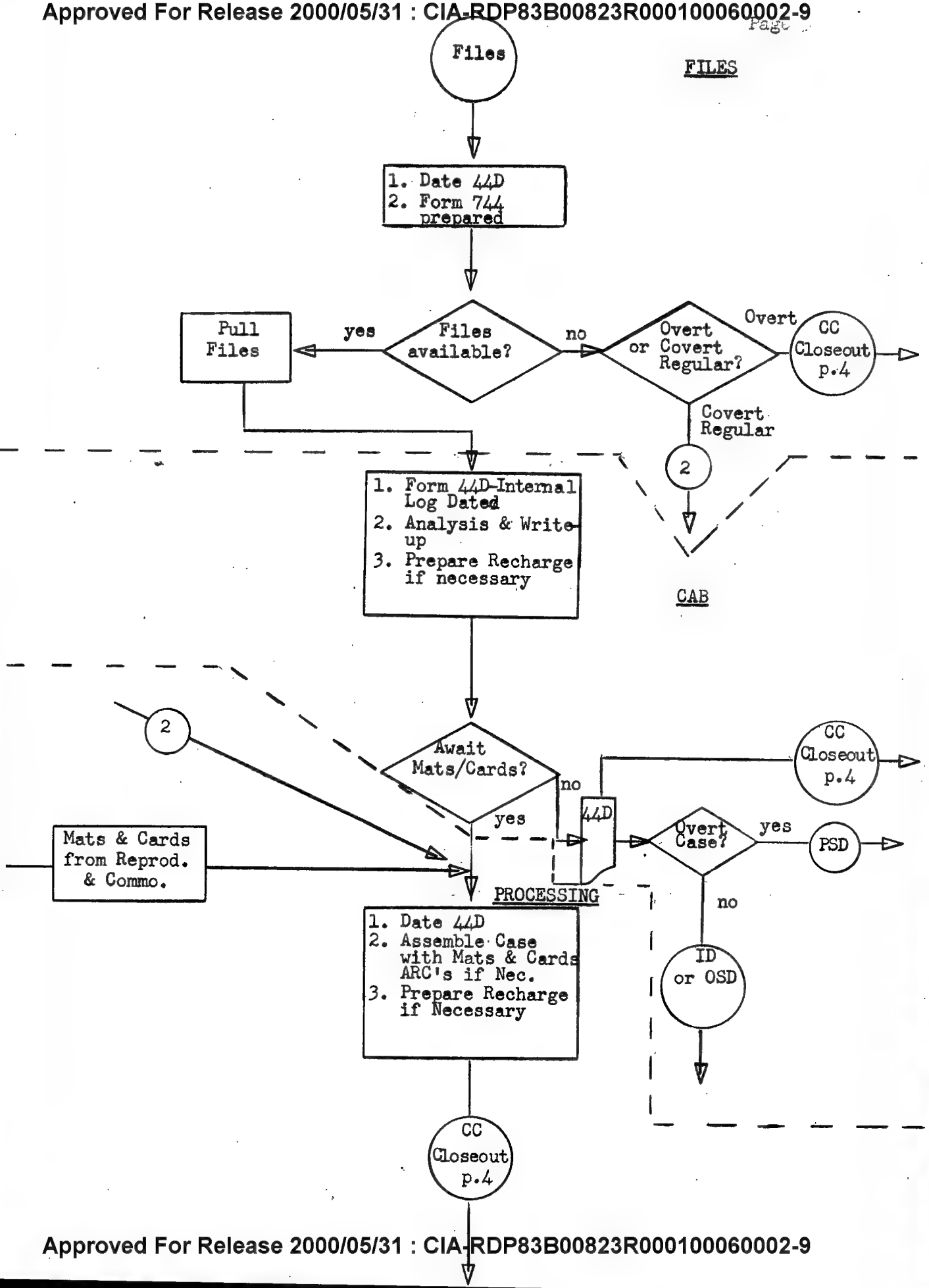
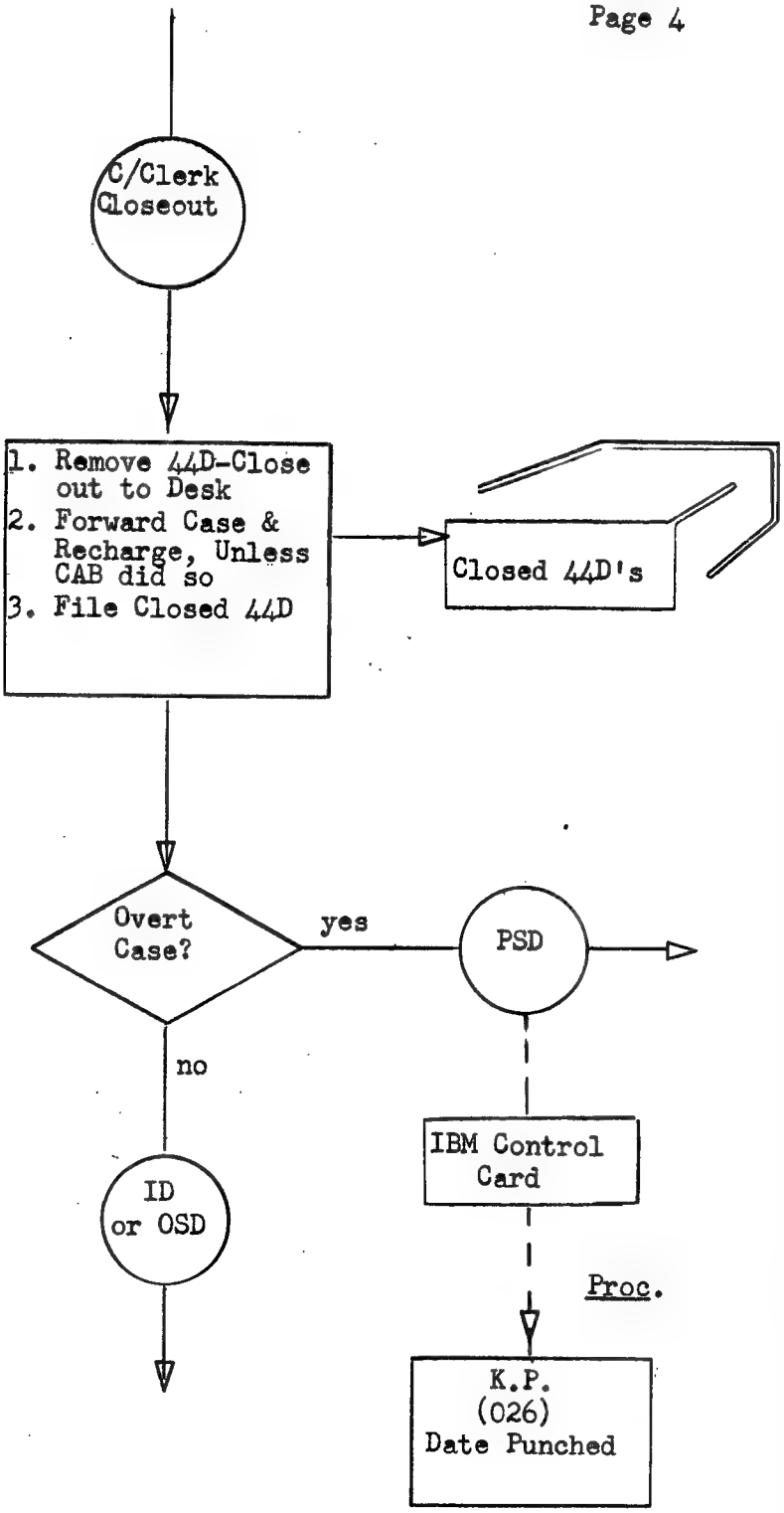
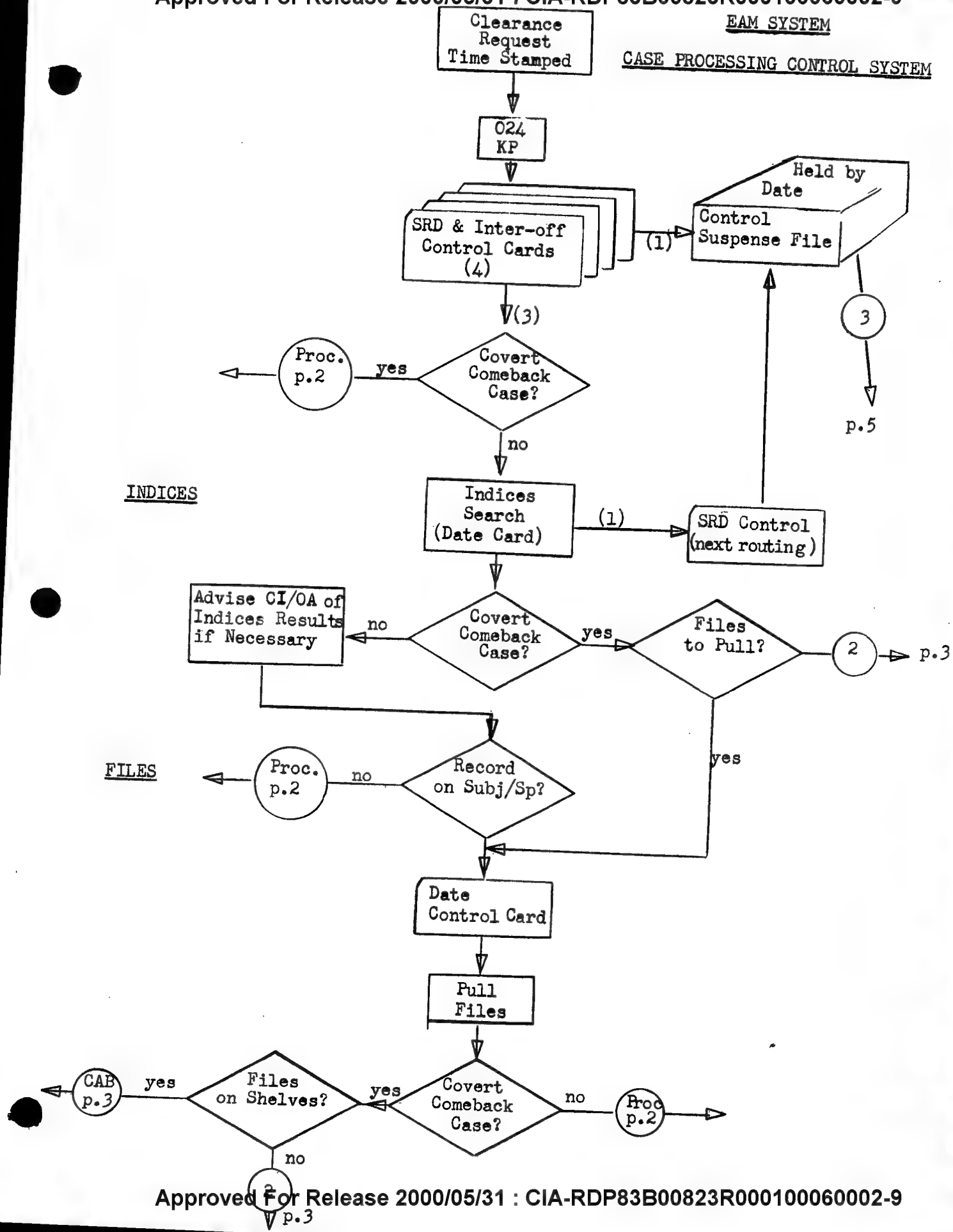




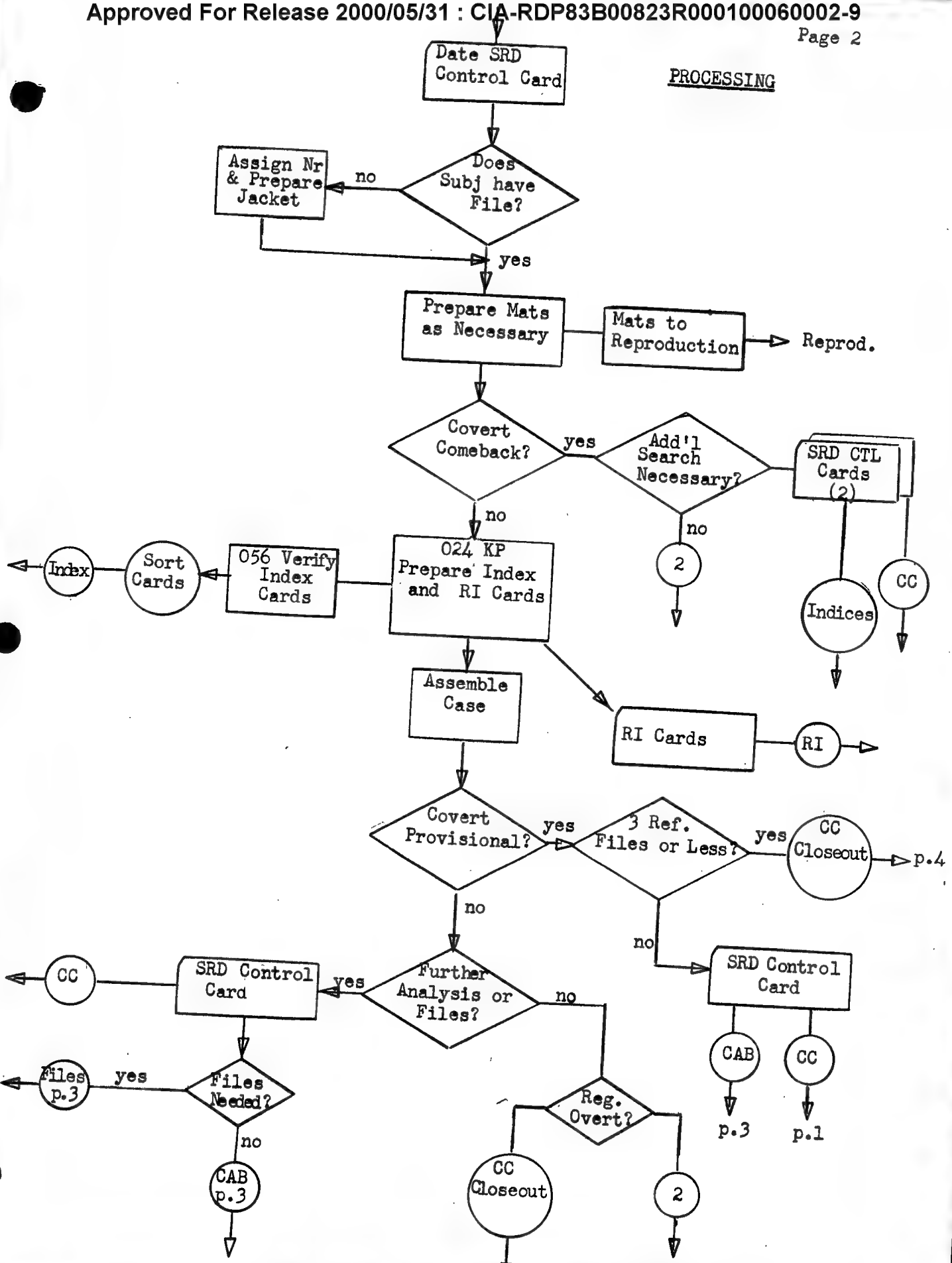
EAM SYSTEM

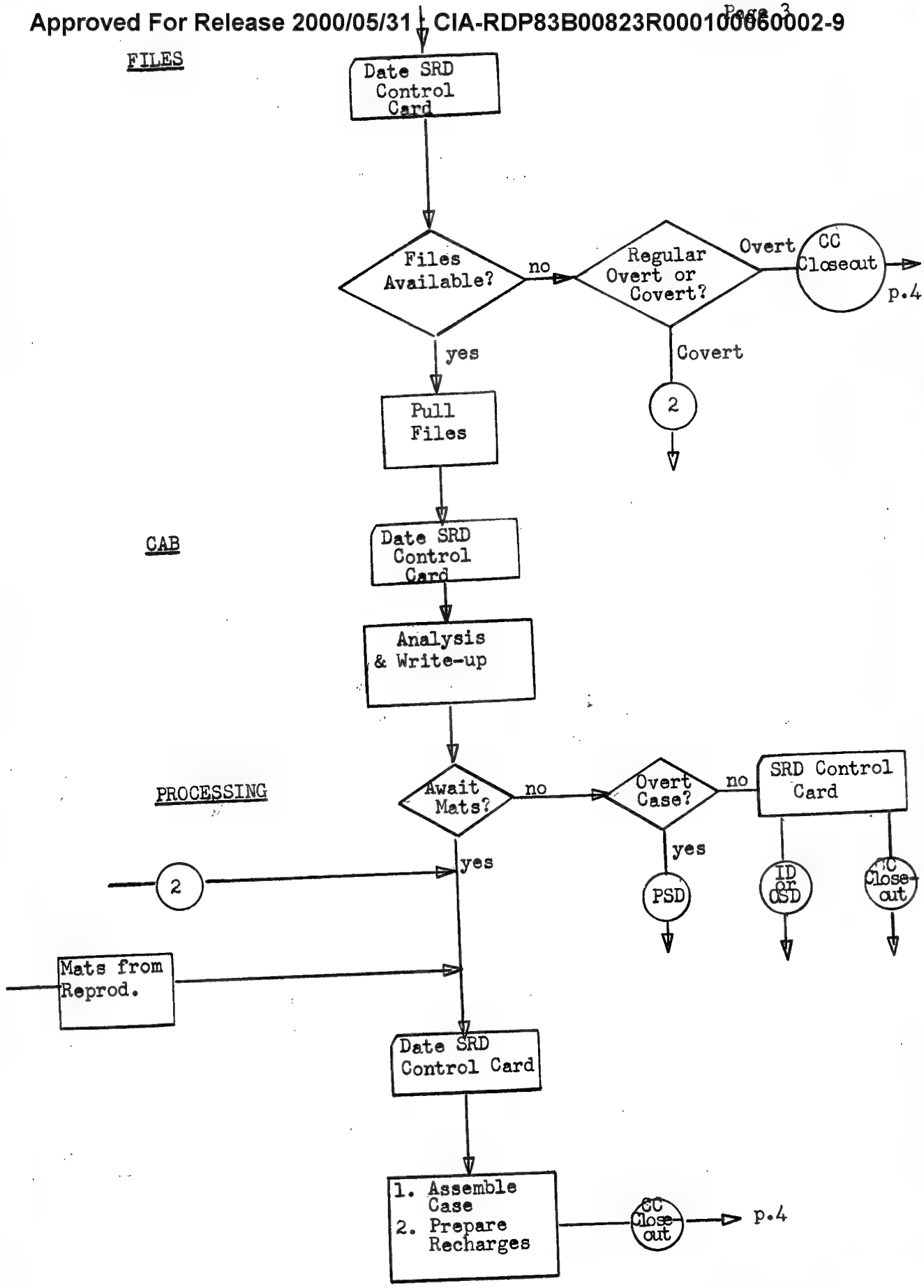
CASE PROCESSING CONTROL SYSTEM

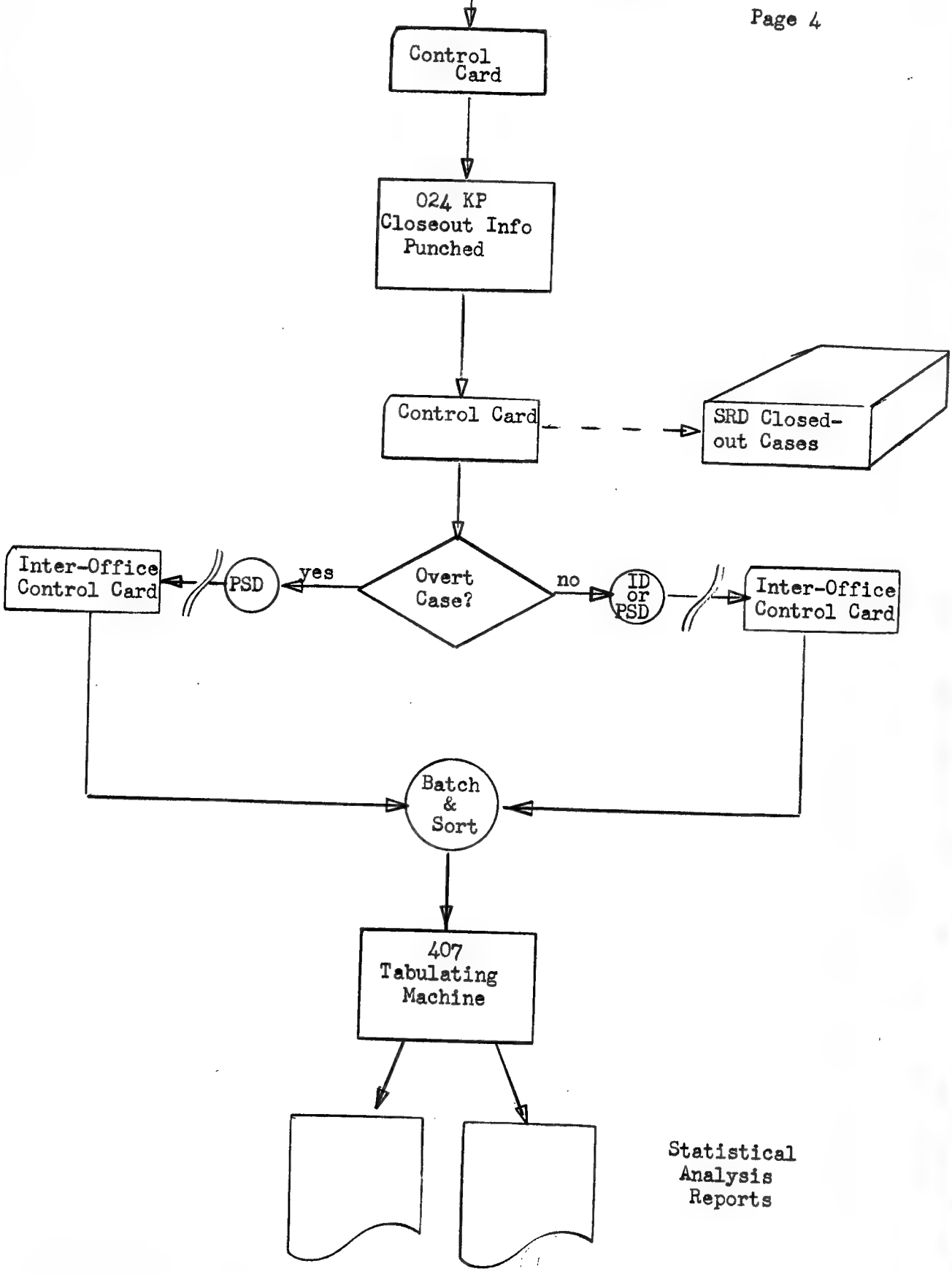


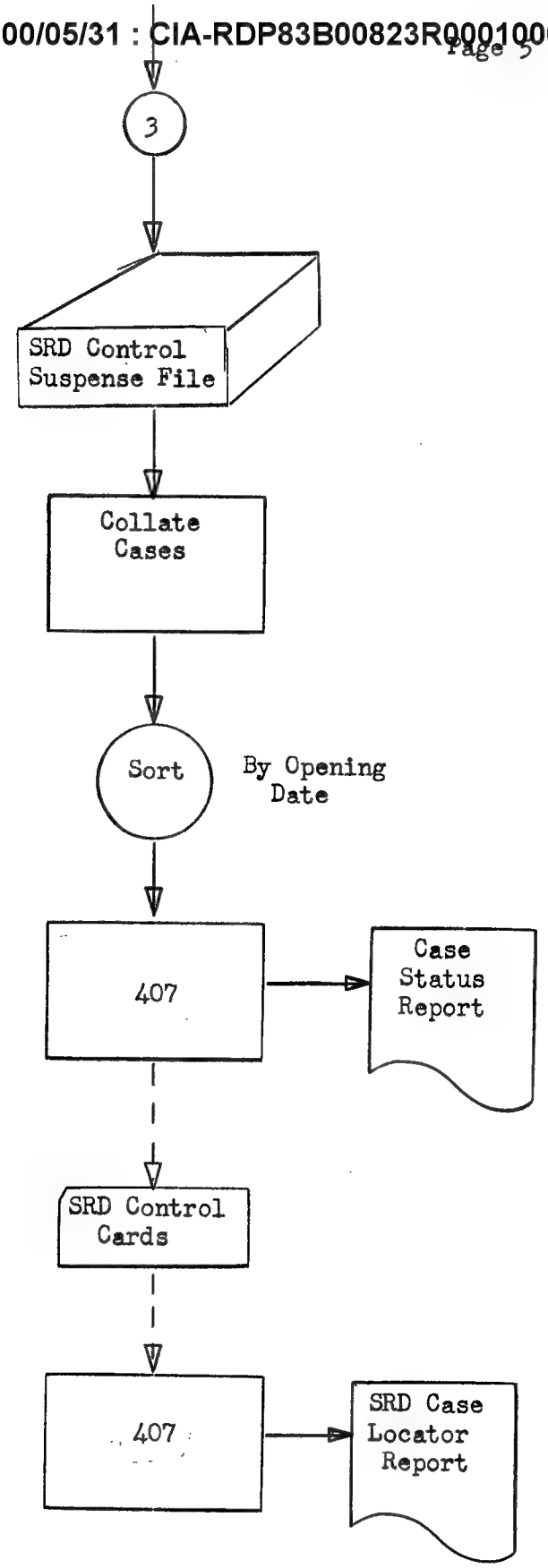
ATTACH 3

PROCESSING



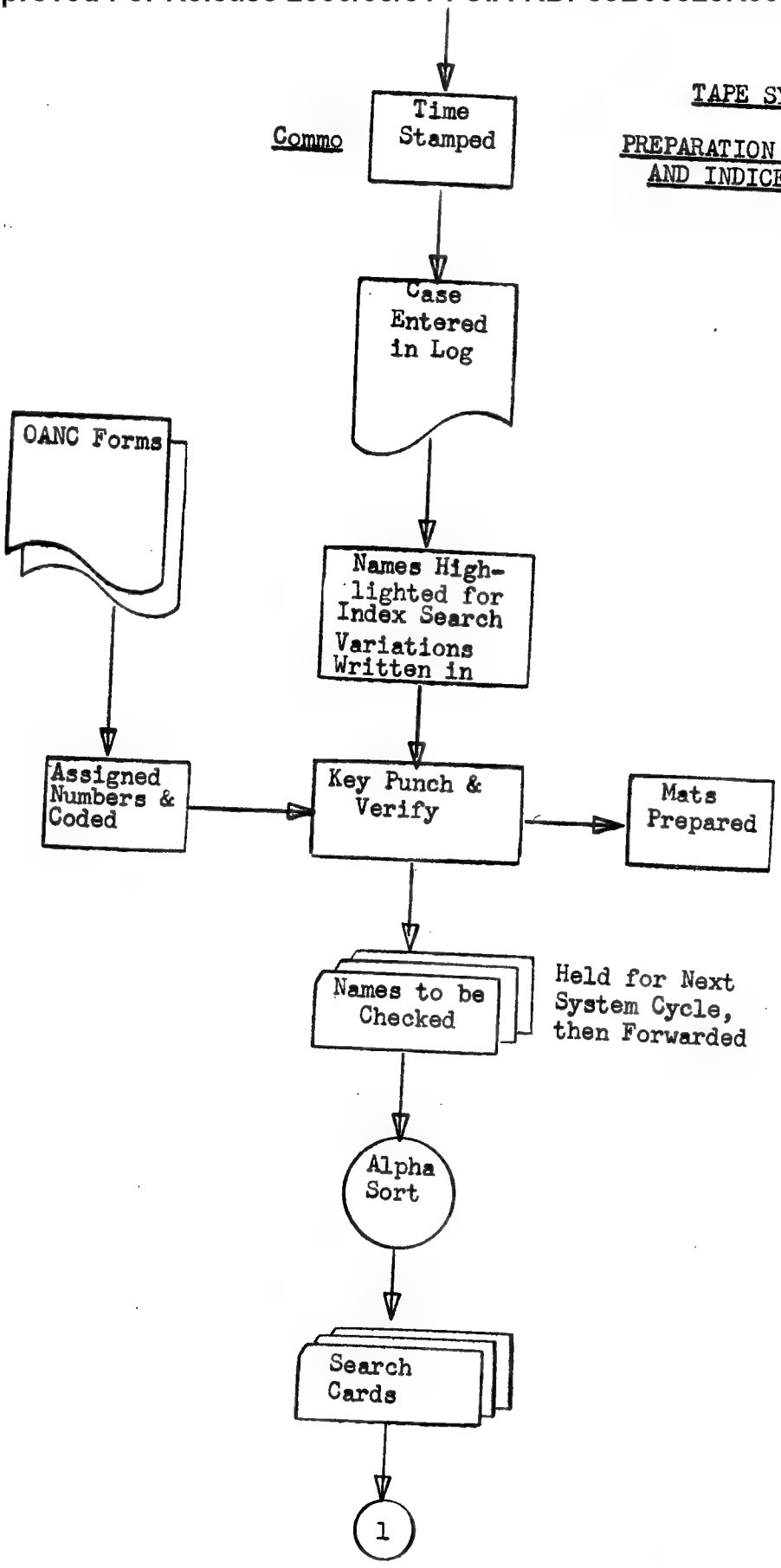




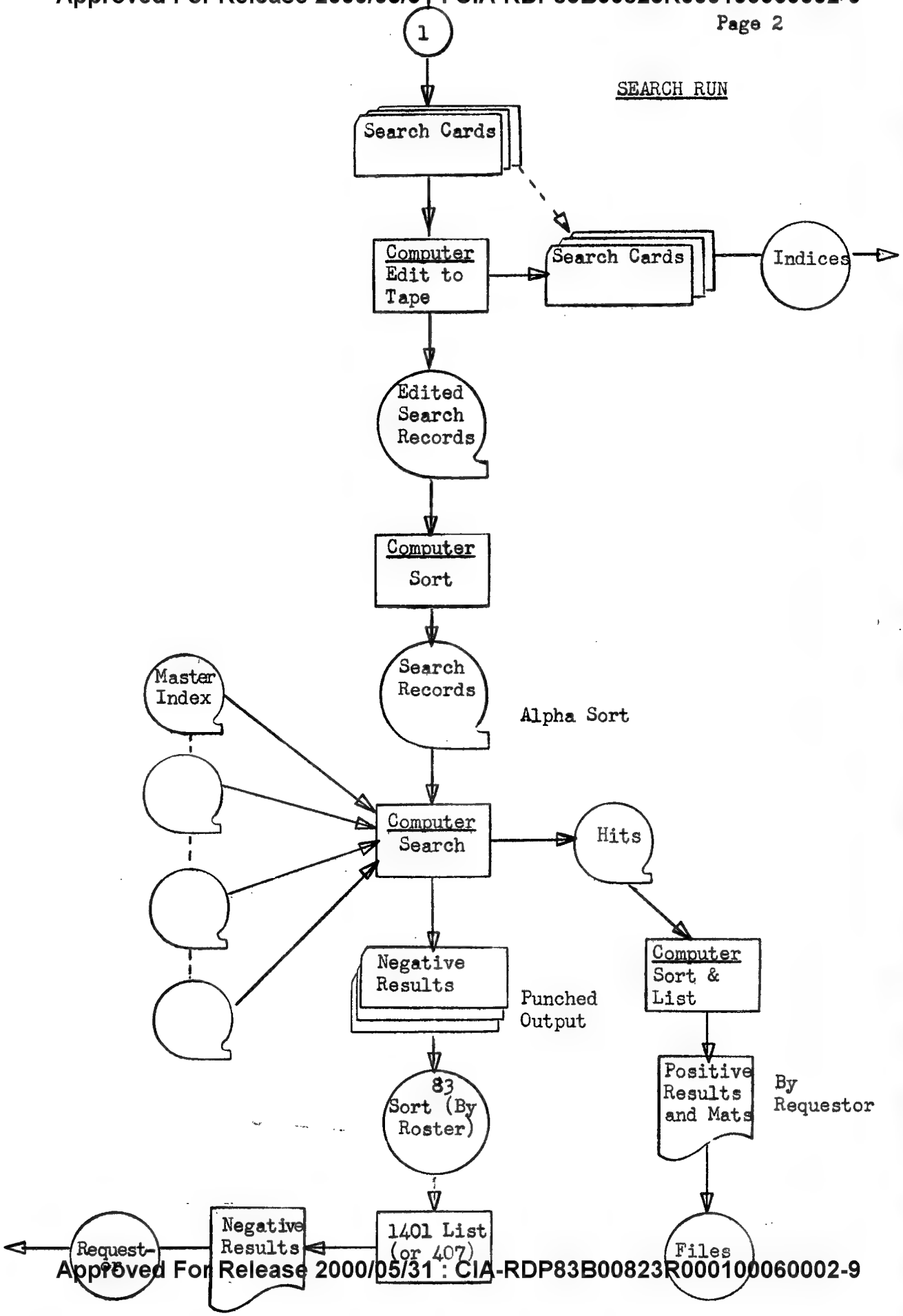


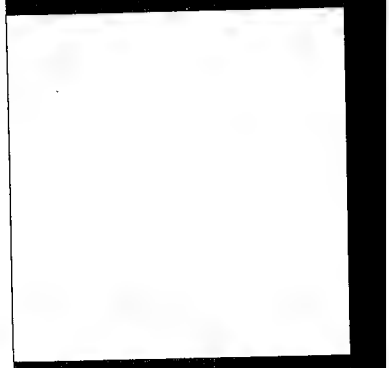
TAPE SYSTEM

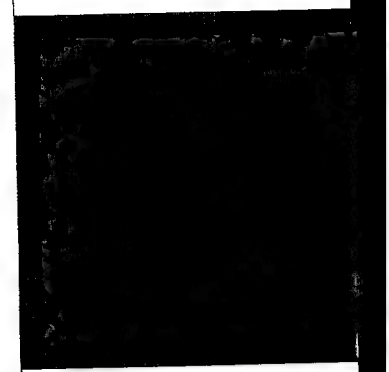
PREPARATION OF INPUT DATA AND INDICES SEARCHING

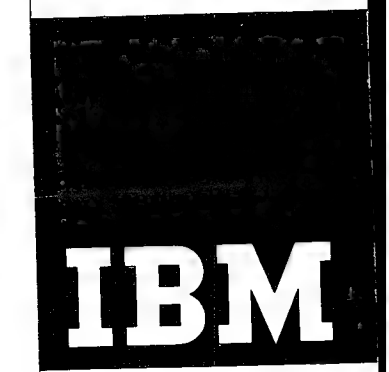


Attach C









General Information Manual

An Introduction to IBM Punched Card Data Processing

IBM

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An Introduction to IBM Punched Card Data Processing

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An Introduction to IBM Punched Card Data Processing

For almost three quarters of a century the punched card has been utilized to solve record-keeping problems. Since the first governmental application of punched cards, their use has extended into virtually every type of commercial and scientific enterprise. The development of the cards, and the machines to process them, began as the result of a specific need. Demands from government, science and industry have brought about today's IBM punched card data processing machines and large electronic computers. They are called data processing machines because their primary function is to process business, scientific or commercial information (data) in such a fashion as to give desired results. Results may take the form of a paycheck, a commission statement, a purchase order, a customer invoice, a sales report, a profit or loss statement, or an inventory report. All of these tasks, and many others, may be performed on the same set of equipment.

The development of the punched cards and the machines to process them was stimulated by the needs of the United States Census Bureau. In 1880 the ten-year census was taken for the tenth time as required by law. Census data was handwritten on large cards. In order to compile facts, the cards had to be hand-sorted into the proper classifications (such as home owner, occupation, etc.) and counted manually for desired totals. They were then sorted and tallied again and again to complete the whole Census Report. This method was tedious, cumbersome and costly, as millions of cards were involved. The possibilities for error were great and checking for accuracy was nearly impossible.

By 1885 the Census Bureau was still struggling to compile the collected facts of the 1880 census into useful and meaningful form. When it became apparent that in the future the compilation could take longer than the ten-year span between each census, the need was realized for a faster and more accurate way to perform the required task. By 1887, when the 1880 Census Report was finally completed, Doctor Herman Hollerith, a statistician with the Census Bureau, had worked out the basis for a mechanical system of recording, compiling and tabulating census facts. His system consisted of recording the census data crosswise on a long strip of paper. The facts were recorded by punching holes in the strip in a planned pattern so that each hole in a specific location meant a specific thing. A special machine was able to examine the holes and electrically perform the tabulation as the long strip was passed over a sensing device. For ease of handling and for durability the paper strips soon were replaced by cards of a standard size and shape. Each card was used to record the facts about an individual or a family — a unit situation. These cards were the forerunners of today's punched cards, or "unit records."

The first users of the punched cards employed them for vital statistics. Some of the early users were the City of Baltimore, the Bureau of Vital Statistics of New Jersey and the Board of Health of New York City. In 1890 tabulating equipment was used for the first time in census work with great success in reducing the time necessary to complete census reports. The completed reports were available for use in two and one-half years, or about one-third of the time spent on the previous compilation, despite an increase in population from 50 million to 62 million in the intervening ten years.

Through the next years the equipment became more developed for the purposes of the Census Bureau. Then came a wider application of the idea. If the equipment was satisfactory for use in tabulating the census, might it not also be suitable for business? The answer was yes, and firms found uses for the equipment, mostly statistical. Insurance companies adopted the machines for analyzing risks in various classifications (actuarial work). Railroads were early users for the analysis of freight statistics. A large department store used punched cards for sales analysis. Cost accounting in a steel company was a commercial use for punched cards prior to 1900.

In the late 1800s and early 1900s, market areas were widened by improved transportation, and manufacturers were adopting mass production techniques. Commercial enterprises were growing. Their record-keeping and accounting functions required more and more personnel. Each individual in the office was performing a smaller part of the overall operation. The time neces-

sary to combine the individual's results with all of the others was excessive. Accounting results were often received so late by management that they were of an historical rather than operational nature. The solution to many such problems was the use of data processing machines, which were employed to reduce the mountains of paperwork, to effect standardization of methods, to speed up results and to reduce the cost of record keeping.

In addition, the application of punched cards to commercial problems has resulted in the ability to manage "by exception." Management is notified of those situations which call for decision at a specific time. For example, in using punched cards for inventory control, only those items which are overstocked or understocked (according to previously established standards) are called to management's attention. The items for which there are adequate inventory amounts are automatically passed over. Management does not have to examine each inventory record to locate the few calling for attention. The time of the individual may be spent on more productive tasks. The importance of this is that many firms maintain thousands of different items in stock.

In recent years record-keeping problems have multiplied because of the size of business, its competitive nature and the demands of management in wanting up-to-date facts with which to guide their business. IBM punched card data processing equipment has been augmented by the development of the electronic computer which enables the user to accomplish data processing tasks hitherto determined impossible. The tremendous power of the electronic computer is the direct outgrowth of the need for it.

The use of the punched card has spread to almost every area of commerce, science and industry, and to almost every size of enterprise within each area. The punched card meets the record-keeping requirements of the small wholesaler, the scientist or the small town just as easily as those of the largest. The success of the punched card in meeting these requirements is expressed through its widespread use in the world today.

Fundamentals of IBM Accounting

The basic principle of IBM accounting: information is recorded once in an IBM card which is then available as required to give desired results by machine processing. Data is registered in IBM cards in the form of punched holes. Once the punching is completed there is a lasting record which may be processed at machine speeds to obtain desired or needed results, when required. Transactions of a similar type are processed together to increase machine effectiveness.

In accounting, one transaction usually affects more than one account. The source document on which the transaction is recorded is used to post to all affected accounts. However, if more than one transaction occurs in a given period, the usual method is to summarize the transactions for that period by each account and then post the total to the appropriate account.

This system requires the sorting of documents manually to obtain the proper groupings. Totals are taken by each group and then posted. For example, in a sales enterprise some of the entries which might be made as the result of a sale are to sales records, accounts receivable ledgers, inventory records, and salesmen accounts. Each posting requires a different sorting of the same source document. Totals are taken manually and posted manually after each sort.

Utilizing the IBM method of accounting, the details of the transactions are punched — one transaction to a card, or unit record. Once the accuracy of the punching is verified, the grouping by account may be accomplished on a sorting machine at a high rate of speed; then the total may be summarized by group mechanically. After that the cards are re-sorted and resummarized by machine. This continues until all the necessary totals have been taken and the entries made.

In summary, the basic principle of IBM accounting is that information once recorded in an IBM card may be used time and time again. Data is punched and verified and may then be classified (sorted) and summarized to produce desired results by machine processing.

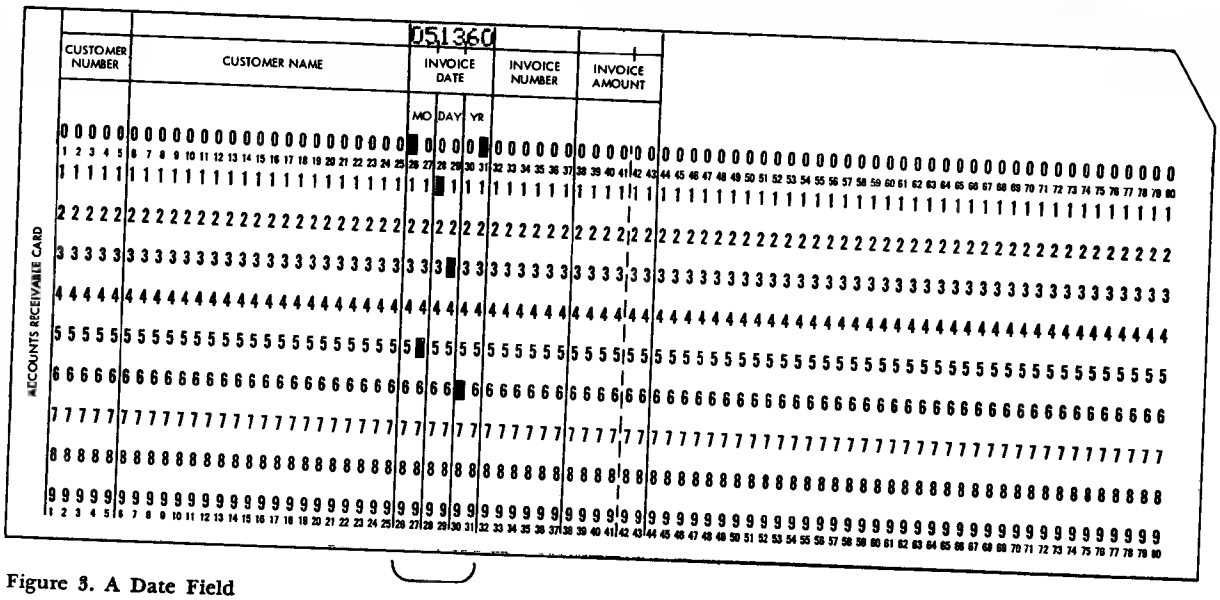

Figure 3. A Date Field

Coding Data

One purpose in assigning codes to data is to enable presentation of the data in the most meaningful, orderly and useful fashion, taking into account the relationship of each item of data with other items of the same or similar nature. The ability to present related data in report form depends greatly upon the coding structure used. The assignment of codes to data is the most accurate and easiest way to express the relationship of items or information. The complexity of the relationships governs the complexity of the coding structure.

Prior to the selection of the type of code used and the assignment of the code to the data, the identity and nature of the data must be analyzed. The informational needs and desires of management are also considered in the analysis.

A code may be alphabetic, numerical, or both, although numerical codes predominate. The simplest type of coding is the assignment of the numbers in sequence to items on a list. Another type is the assignment of numbers in sequence to data in alphabetic order, such as a listing of names or firms. Other codes more sophisticated take into consideration family relationships of data. such as related items of hardware, screws, nails, garden implements, and so forth. Some codes are constructed so that each segment of the code is descriptive of a specification of an object, such as bolt, carriage, steel, hexagonal head, 2 inch, etc.

The use of a coding structure usually permits faster machine processing in classifying or arranging. This results from the ability to act upon the code number rather than the longer designation of the data. By coding there is often a saving in the number of card columns utilized, thus reducing the amount of card punching.

The use and assignment of codes does not mean that the user must familiarize himself with the coding structure involved. Reports usually reflect the data designation by name rather than the code number, although both are often printed.

Punching and Verifying Data

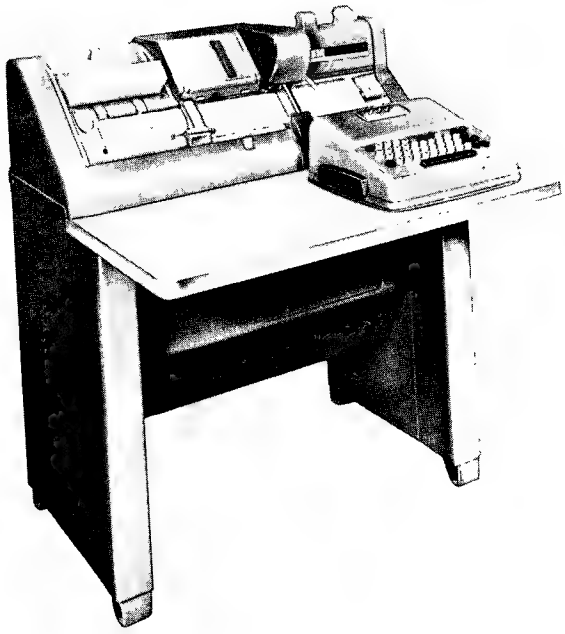

Figure 4. The IBM 26 Printing Card Punch

Data is recorded in the form of punched holes by means of a card punch. The IBM 26 Printing Card Punch is illustrated in Figure 4. A keyboard on the punch, similar to that of a typewriter, is activated by key depression to cause punching of the proper letter, digit or special character in a card column. Data being punched may be printed at the top of the column depending upon the type of punch used. The punch operates serially; one column at a time is punched. After one column is punched the card is automatically positioned for punching the next.

Cards pass through the punch as indicated in Figure 5. A card moves from the card hopper to the punching station. After punching, the card is automatically released to the reading station. The card then passes through the reading station in phase, column by column, with the card behind at the punching station. After the card behind it is released from the punching station, the card at the reading station moves into the card stacker.

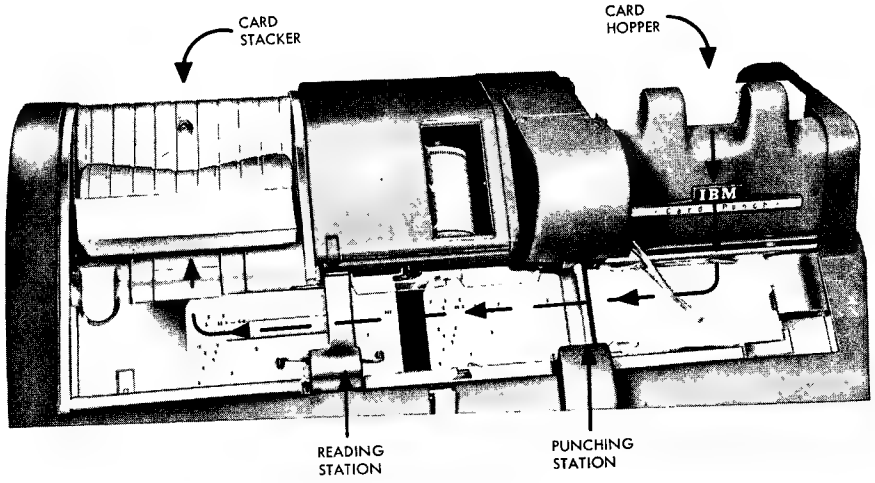

Figure 5. The Path of the Card through the Punch

The IBM Card

The IBM card measures 7⅜ inches by 3¼ inches and is .007 inches in thickness. The card stock is of controlled quality which must meet rigorous specifications in order to provide strength and long life. This is necessary to insure the accuracy of results, the proper operation of IBM data processing machines and the continued usability of information long after it is recorded.

The card is divided into eighty vertical areas called "columns" or "card columns." They are numbered one to eighty from the left side of the card to the right. Each column is then divided into twelve punching positions. Thus in the IBM card there are 960 punching positions altogether. The punching positions are designated from the top to the bottom of the card by 12, 11 or X, 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. The punching positions for digits 0 to 9 correspond to the numbers printed on the card. The top edge of the card is known as the "12 edge" and the bottom of the card is known as the "9 edge." These designations are made because cards are fed through machines either "9 edge first" or "12 edge first." "Face up" means the printed side is facing up and "face down" means the opposite.

Each column of the card is able to accommodate a digit, a letter or a special character. Thus the card may contain up to eighty individual pieces of information. Digits are recorded by holes punched in the digit punching area of the card from 0 to 9. For example, in the card in Figure 1, there is a 1 punched in column 63, a 9 in column 72 and a 4 in column 77.

The top three punching positions of the card (12, 11 or X, and 0) are known as the zone punching area of the card. (It should be noted that the 0 punch may be either a zone punch or a digit punch.) In order to accommodate any of the 26 letters in one column, a combination of a zone punch and a digit punch is used. The various combinations of punches which represent the alphabet are based upon a logical structure (or code).

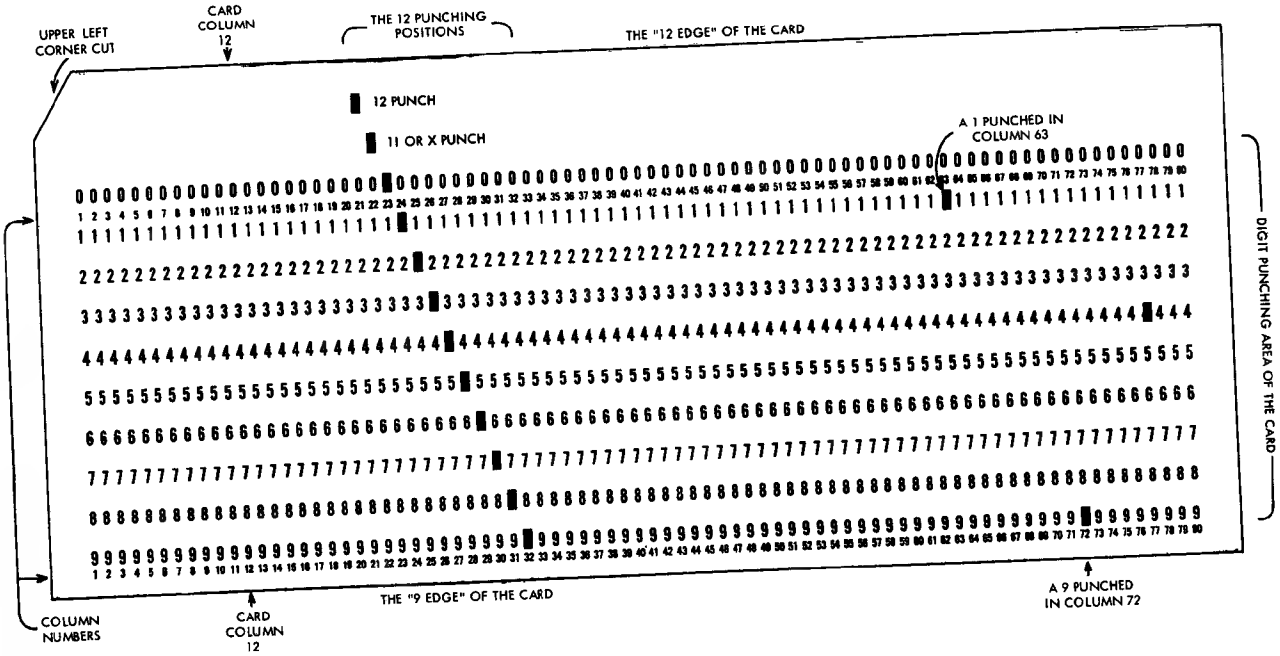

Figure 1. An IBM Card

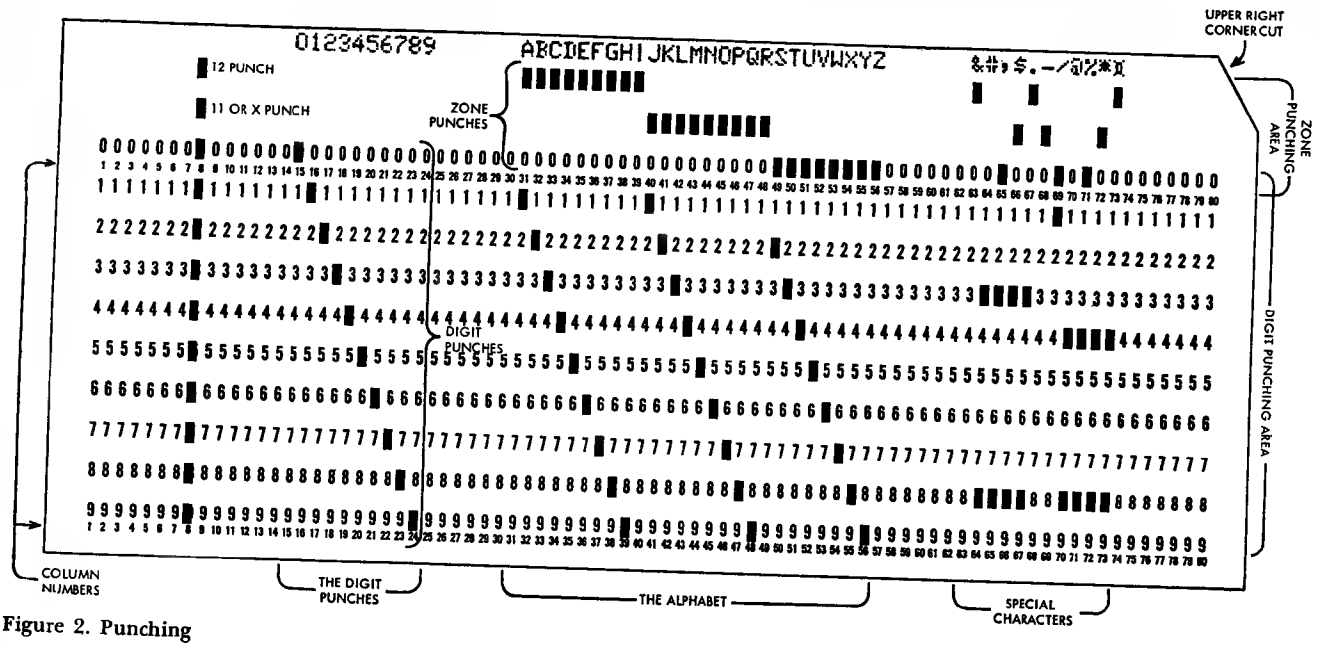

Figure 2. Punching

The first nine letters of the alphabet, A to I, are coded by the combination of a 12 punch and the digit punches 1 to 9. Letters J through R are coded by an 11 or X punch and the digits 1 through 9. S through Z, the last eight letters, are the combination of the 0 zone punch and the digit punches 2 through 9. This alphabetic coding is illustrated in Figure 2. The conversion of letters to and from this coding structure is done automatically by the various machines used to record or process data and it is rarely necessary to refer to data in its coded form.

The eleven special characters are recorded by one, two or three punches. Their function is to provide printed symbols as required, to cause certain machine operations to occur, or to identify various cards.

Cards are divided into segments called "fields." A field is a column or columns reserved for the punching of data of a specific nature. The field may consist of one column or eighty columns, depending upon the length of the particular type of information. For example, a name and address field would be longer than a telephone number field. Machine processing requires a standard arrangement of data in the card; therefore, once a field is assigned to a specific purpose, it is reserved for one kind of data in cards used in the same job.

Field length is determined by the maximum length of information which will be entered into the field. A numerically coded date may take up only six columns, so a field of six columns is assigned for the punching of the date. A typical date field is illustrated in Figure 3. A company engaging in sales activity may have only 34 salesmen, with no prospect of having more than 99 salesmen. A two-column field would be assigned to the recording of salesman number. If the company were expanding rapidly and an increase in the sales force to 100 or more were anticipated, a three-digit field would be assigned. Field assignment and card layout are usually made after analysis of individual needs.

Figures 1 and 2 illustrate the two most common types of corner cuts – upper left and upper right. The corner cut is used to identify visually a card type or to insure that all of the cards in a group are facing the same direction and are right side up. Card types may also be identified by the use of colored cards or the use of a colored stripe on cards of a similar nature.

Because a card passes the reading station in phase with the card at the punching station, it is possible to have automatic duplication from card to card. The information in a specific column of a card at the reading station may be read and transmitted back to be punched in the same column of the card at the punching station.

The ability to duplicate from card to card reduces the amount of manual punching necessary. Data common to a group of cards (such as a date) may be punched into the first card of a group and then duplicated into the rest of the cards in that group. Duplication may be started by the depression of a key, or it may be under the preplanned control of the machine itself upon reaching the first column of the field to be duplicated.

Other functions which may be under automatic or manual control of the punch are skipping, ejecting and feeding, and printing. Because cards are punched in batches by type of job, a pattern of punching is established which permits instructing the punch to skip fields, duplicate fields or release the card when punching is complete. This instruction of the punch to skip, duplicate or release at a particular card location is known as programming.

The ability to perform many of the machine functions automatically permits faster job processing. Skipping takes place at the rate of 80 columns per second. Automatic feeding of a card takes one-fourth of a second. Duplication proceeds at a rate of either 18 or 20 columns per second, depending on the type of punch. The ability to duplicate from one card to the next increases overall punching speed, and accuracy is increased because the possibility of error is reduced. Data to be duplicated is punched once and then automatically copied at machine speed.

In addition, the ability to duplicate makes the correction of punching errors easier. If an error is noted, the card is duplicated up to the point of error, the correct data is punched and then the rest of the card is duplicated. Thus only the incorrect portion needs to be repunched.

From right to left the positions in a field are known as the units position, the tens position, the hundreds position, thousands position and so on. Numbers to be punched may be labeled in the same fashion. Punching is from left to right with the units position of the number punched in the units position or right-hand column of the field. If the number to be punched is shorter than the field, zeros are added to the left until the number equals the field size.

For example, if the number to be punched is 764 and the field is five columns in length, the number as punched would be 00764 and would appear as illustrated in Figure 6. Because the fields are laid out in advance to accommodate the maximum number of digits expected, data should not exceed field size.

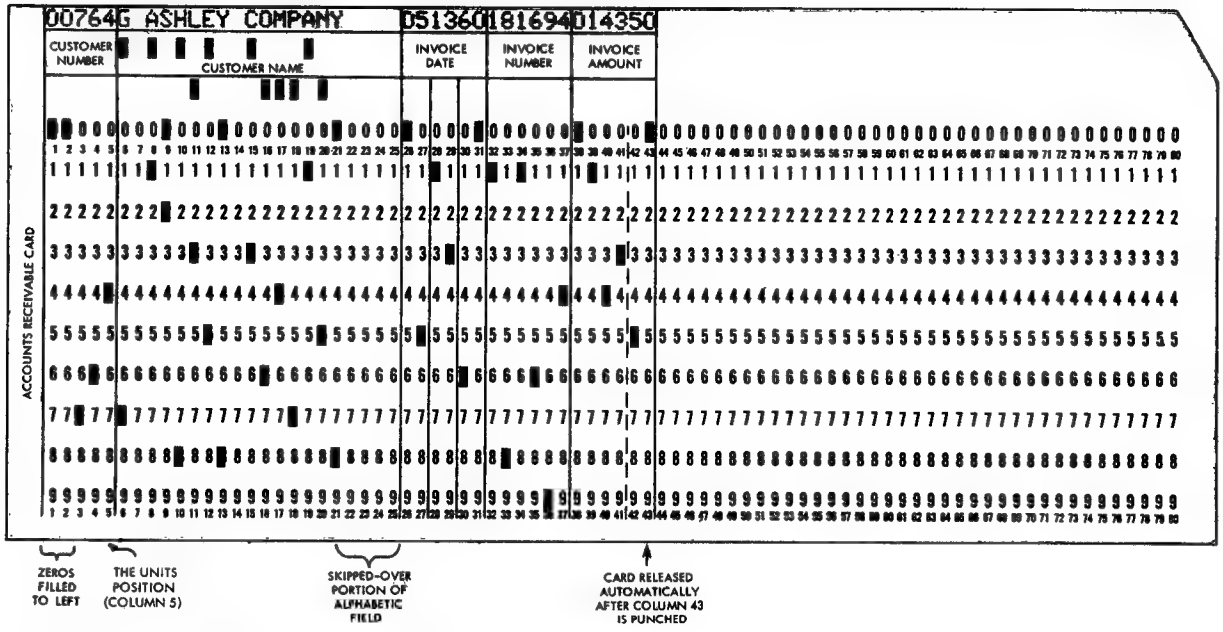

Figure 6. Examples of Punching Practices

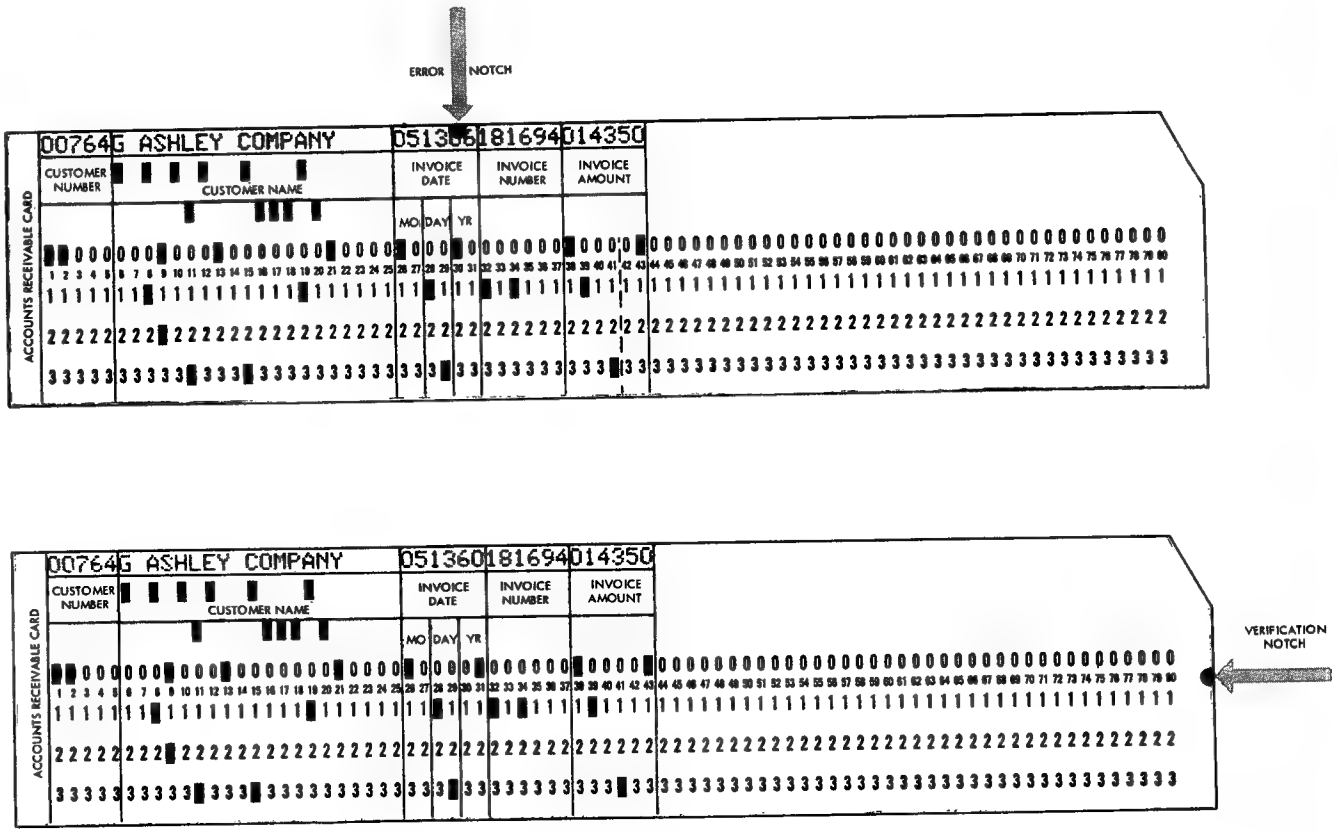

Figure 7. Error and Verification Notches

In punching an alphabetic field, the punching starts in the leftmost column of the field and continues to the last letter to be punched or the end of the field. If alphabetic data does not fill the field, the remainder of the field is skipped over unpunched, as illustrated also in Figure 6.

After cards have been punched, the data in them is usually checked for punching accuracy. The two most common methods are visual and machine verification. Visual verification involves reading the data printed at the top of the card during punching and comparing what is read with the data on the source document. This method may be accomplished by one person alone or by one person proofreading to another. The data may also be printed from cards and then proofread.

Machine verification is performed on the IBM 56 Verifier, a machine similar in appearance to the card punch. The first station of the verifier is called the verifying station rather than the punching station. The operation is similar to card punching. Previously punched cards are placed in the hopper and the first card is fed into position at the verifying station. Reading the source document, the operator depresses keys as if punching.

As the proper key of the keyboard is depressed, a thin metal plunger passes through the hole or holes previously punched in a column. The plunger passing through the hole permits the card to advance to the next column. If an error was made in the original punching of the card, the plunger will have no opening through which to pass and the card will not advance to the next column. After depression of the proper key and no column advance, the machine recognizes an error condition and puts a notch over the incorrect column, as shown in Figure 7. The last digits in the date field are transposed. Correctly punched and verified cards are notched as indicated.

Principles of IBM Machine Processing

The IBM card with data punched in it serves two major functions. The card is the means by which the data is stored; information in the card is available over long periods of time for use as needed. The card also serves as the conveyor of the data, as it is the means by which the data is introduced into IBM machines for processing.

Before data in the card is processed the machine must change the punched holes into electrical impulses. IBM machines operate on data which has been converted into electrical impulses. The process of converting the punched holes in a card into electrical impulses is known as "reading." Reading is done by the completion of an electrical circuit through the hole punched in a card column.

As a card passes into the machine each column goes under a separate wire brush. If there is a hole in a column, the brush makes contact with a source of electricity (the contact roller) through the hole, creating an electrical impulse which the machine is able to process. The impulse is of short duration, lasting only as long as contact is maintained through the hole by the roller and the brush. If there is no hole in a column, no circuit is completed and there is no impulse. The thickness of the card and its nonconductive qualities prevent contact. Between cards, contact is made, but no impulse is created. The principle of card reading, or converting the punched hole into an impulse, is illustrated in Figure 8.

The passage of the card between the brushes and the contact roller occurs at a specific time in the cycle of the machine. Because of this relationship between the card movement and the machine, the difference in impulses created by different holes in a column is recognized. Thus the punched hole is actually converted into a "timed" electrical impulse. A hole in the 3 position of a column gives an impulse at a different time than a hole in the 9 position or a 4 or a 2. Furthermore, if there is more than one hole in a column, two or more impulses are created, each of which is distinct to the machine.

Once data has been converted into electrical impulses, the impulses are processed by the machine. The type of processing which the data undergoes depends upon the type of machine used and the results desired. Once processing has occurred, the results are in the form of impulses also. These resulting impulses are then converted into output form, which may be holes punched in the same card or another, a printed line, a machine function, or some combination of these.

The processing cycle is thus: cards are fed into machines which "read" the data and convert it from punched holes into electrical impulses. The impulses are processed, resulting in other impulses which are then converted into the desired output form or function.

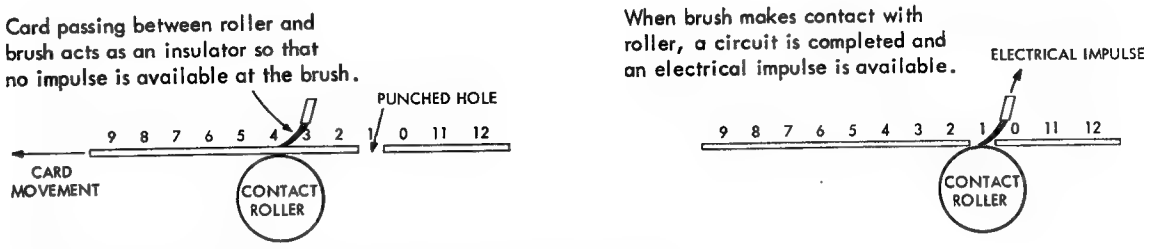

Figure 8. Converting the Punched Hole into an Electrical Impulse

Sorting Data

Prior to the preparation of data in report form, the data is arranged in an orderly fashion for easy use and ready reference. The process of arranging data in a sequence which will meet a specific requirement is known as sorting, or classifying. Data arrangement is accomplished on the sorter. The three basic types of classification performed on the sorter are sequencing, grouping and selecting.

Sequencing is the process of arranging data in alphabetic or numerical order, either ascending or descending. For example, it may be desirable to have a register of current transactions. Before preparing the transaction register, the cards representing the transactions are sorted on the transaction number field by means of a sorter. The transaction numbers are in ascending sequence after sorting. Thus any transaction might be referred to on the subsequent report with a minimum of effort. Sequencing is illustrated in Figure 9.

Grouping is the process of arranging like items together. For example, it may be desirable to have a report showing sales by each salesman. The cards are sorted on the salesman number field, which results in the grouping by salesman needed for the report. Grouping prepares data for reports in summarized form, or for analysis of like data. Figure 10 shows an example of grouping.

Selecting is the process of extracting a desired item or items of data from a larger file of data. If all credit transactions are needed to prepare a special analytical report, it is possible to remove them from a file of all transactions. This is done on the sorter without disturbing the sequence of the remainder of the file. Because of this ability to select specific data, reports reflecting only items under consideration may be prepared. Selecting is illustrated in Figure 11.

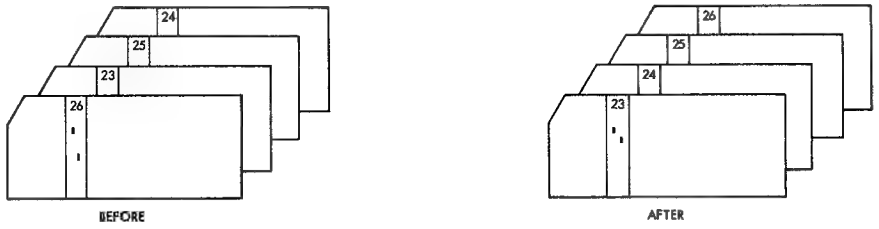

Figure 9. An Example of Sequencing

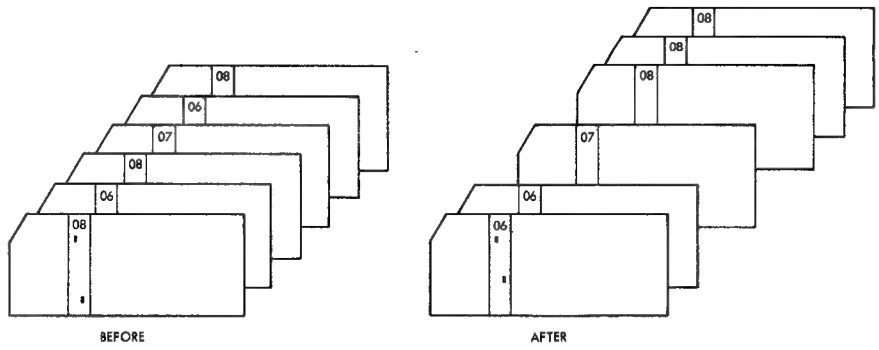

Figure 10. An Example of Grouping

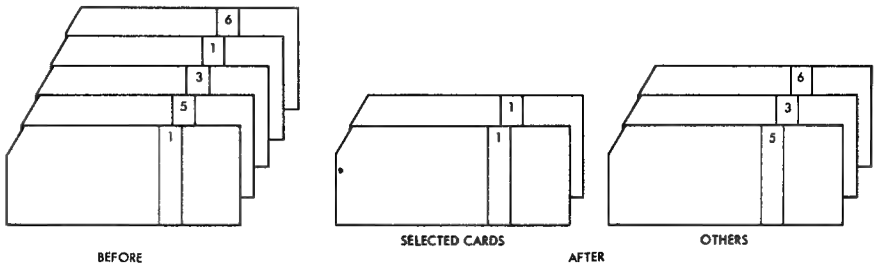

Figure 11. An Example of Selecting

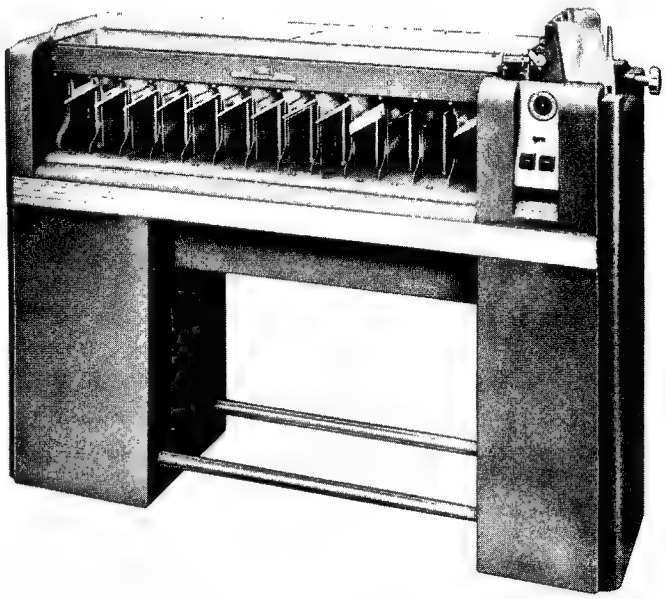

Figure 12. The IBM 82 Sorter

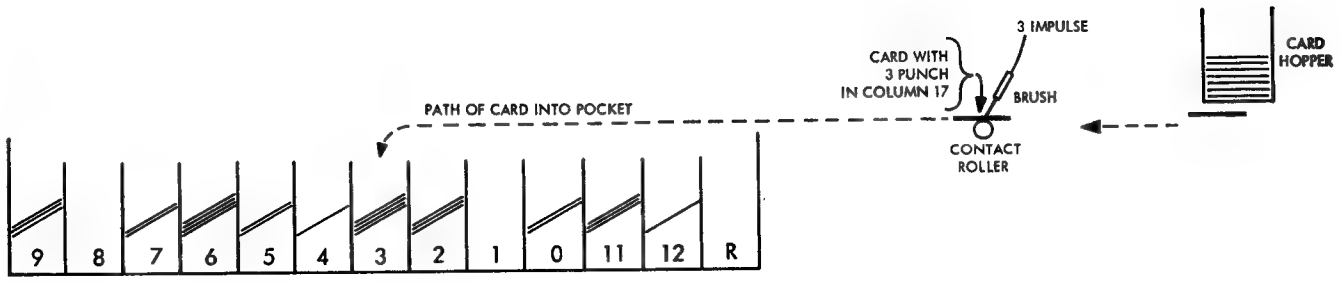

Figure 13. Diagram of Sorter Operation

There are a number of different IBM sorters which may be used for data arrangement. They range in speed from 450 cards per minute to 2,000 cards per minute. The IBM 82 Sorter is illustrated in Figure 12. Its speed is 650 cards per minute.

An IBM sorter operates on one column of data at a time. The sorter has 13 pockets to receive sorted cards. There is a pocket for each of the punching positions in a column, and one pocket for cards with no hole in the column being sorted. Because one column is sorted at a time, only one brush is needed by the sorter for reading. This brush is movable and is placed to pass over the column being sorted. As contact is made by the brush with the contact roller through a hole punched in the column, an impulse is created which is used to open a path for the card to be carried by other rollers to the appropriate pocket. For example, if there is a 3 in column 17, which is the column being sorted, the impulse created at "3 time" opens the path for the card to fall in pocket 3. A 7 punch causes the card to be directed into the 7 pocket, etc. Figure 13 illustrates sorter operation.

If the data field being sorted is five digits in length, the group of cards must be sorted five times. Alphabetic information may also be sorted. Two sorts per column are required, one for the digit punch of the letter, and the other for the zone punch.

The Accounting Machine

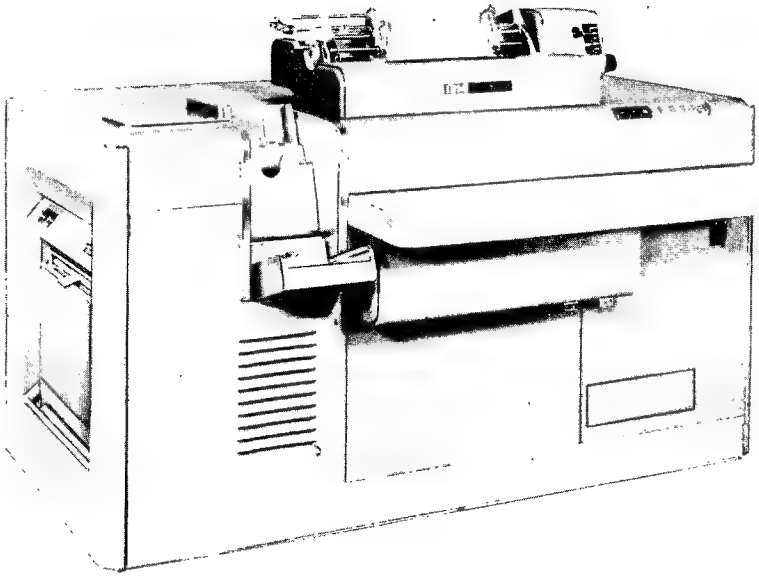

Figure 14. The IBM 402 Alphabetical Accounting Machine

The basic purpose of the accounting machine is two-fold: to print alphabetic and numerical data from punched cards in an orderly, meaningful and desired fashion, and to total data by proper classifications. Accounting machines vary in the number of totals which may be accumulated at one time, in speed and in processing capacity. The type and capacity of the machine used depends upon the requirements of the individual task. The accounting machine illustrated in Figure 14 is an IBM 402 Alphabetical Accounting Machine. The 402 prints up to 88 characters on a line at speeds up to 100 lines per minute, while accumulating up to 80 positions of totals.

The printing unit consists of two sections of typebars which print the data. The left section contains 43 typebars, each capable of printing any alphabetic or numerical character. The right section has 45 typebars which print numerical data. Up to 88 characters may be printed simultaneously on one line of the report. To take full advantage of the printing speed of the 402, report forms in continuous form are used. Hand feeding of single forms is thus eliminated. Forms spacing and positioning during printing are performed automatically. After printing, the forms are usually separated. Preprinted headings on the report forms permit easy reference to the data. A number of carbon copies may be made at the same time by using multiple-part forms.

Printing is performed in two different manners. Data may be printed from cards with one line printed per card. This method is known as detail printing, or listing. Detail printing is performed when complete information about transactions is desired, such as for registers, statements of account or detailed inventory transaction listings. All of the information in a card or specific segments of the data may be printed on the report form in the sequence desired. At the same time, transaction amounts may be added and subtracted in counters for totals. Figure 15 illustrates an inventory transaction listing.

UNITS
EA = EACH C = HUNDRED
DZ = DOZEN GR = GROSS
M = THOUSAND

INVENTORY TRANSACTION LISTING

TRANSACTION CODES
1. BALANCE FORWARD 4. ISSUES FROM STOCK
2. RECEIPTS FROM VENDORS 5. RETURNS TO STOCK
3. RETURNS TO VENDORS 6. DEBIT ADJUSTMENT
7. CREDIT ADJUSTMENT

DATE: 3/ 31 /

PART NUMBER	PART NAME	UNIT	UNIT COST	TRANSACTION REFERENCE NUMBER	TRANSACTION DATE	TRANS CODE	OPENING BALANCE	TRANSACTIONS RECEIPTS	TRANSACTIONS ISSUES	ON HAND
171203	WATER PAIL 1 G	EA	1.89		2 28	1	68			
171203	WATER PAIL 1 G	EA	1.89	16129	3 03	4			36	
171203	WATER PAIL 1 G	EA	1.89	16431	3 07	4			18	
171203	WATER PAIL 1 G	EA	1.89	A0649	3 10	2		144		
171203	WATER PAIL 1 G	EA	1.89	16842	3 14	4			40	
171203	WATER PAIL 1 G	EA	1.89	17361	3 21	4			12	
171203	WATER PAIL 1 G	EA	1.89	C0036	3 22	5		1		
171203	WATER PAIL 1 G	EA	1.89	D0567	3 22	3			1	
171203	WATER PAIL 1 G	EA	1.89	18902	3 30	4			24	
171203						1				82*
171364	FRYING PAN 4 IN	EA	.94		2 28	1	84			
171364	FRYING PAN 4 IN	EA	.94	15937	3 01	4			6	
171364	FRYING PAN 4 IN	EA	.94	16389	3 04	4			15	
171364	FRYING PAN 4 IN	EA	.94	B1089	3 07	6			1	
171364	FRYING PAN 4 IN	EA	.94	17361	3 21	4			36	
171364	FRYING PAN 4 IN	EA	.94	18437	3 25	4			6	
171364	FRYING PAN 4 IN	EA	.94	18866	3 29	4			18	
171364	FRYING PAN 4 IN	EA	1.04	A0676	3 30	2		156		
171364						1				158*
171366	FRYING PAN 6 IN	EA	1.25			1	148			
171366	FRYING PAN 6 IN	EA	1.25	16150	3 03	4			24	
171366	FRYING PAN 6 IN	EA	1.25	A0640	3 08	2		180	36	
171366	FRYING PAN 6 IN	EA	1.25	16820	3 14	4			12	

Figure 15. An Inventory Transaction Listing

The other way in which data may be printed is by group printing. In this method of printing, data from cards is summarized by each different classification. The line printed for a particular classification contains group identification and the totals. Group printing is performed at speeds up to 150 cards per minute. Figure 16 shows a Stock Status Summary, a group printing of the same data listed on the report in Figure 15.

Group printing may be accomplished because of the ability of the accounting machine to distinguish cards of one classification from those of another. As cards pass through the accounting machine, data in a specific field of one card is compared with data in the same field of the card following. If the data in both fields is the same, each card is recognized as being of the same group. If comparison indicates the data is different, the lead-

STOCK STATUS SUMMARY

DATE: 3/ 31 /

PART NUMBER	PART NAME	UNIT	UNIT COST	OPENING BALANCE	TRANSACTIONS RECEIPTS	TRANSACTIONS ISSUES	ON HAND
171203	WATER PAIL 1 G	EA	1.89	68	145	131	82*
171364	FRYING PAN 4 IN	EA	1.04	84	156	82	158*
171366	FRYING PAN 6 IN	EA	1.25	148	180	175	153*
171368	FRYING PAN 8 IN	EA	1.38	75	288	184	179*
171370	FRYING PAN 10	EA	1.54	64	72	56	80*

Figure 16. A Stock Status Summary

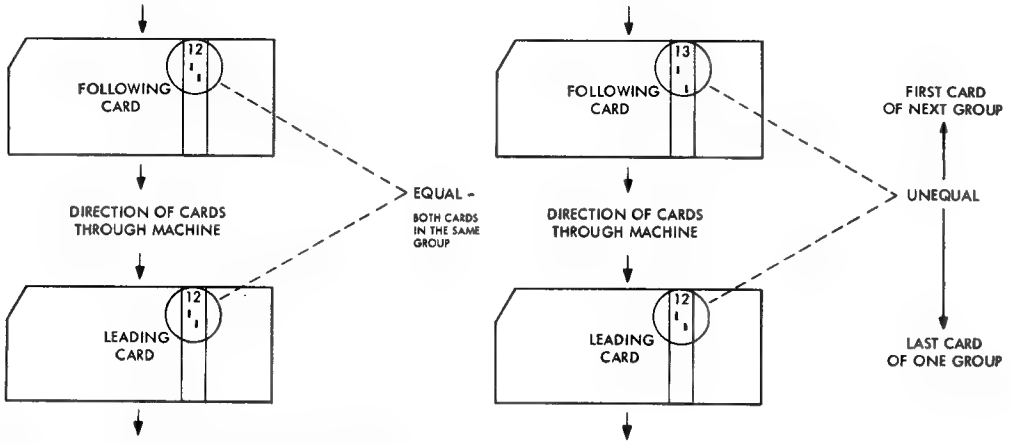

Figure 17. Equal and Unequal Comparisons

ing card is recognized by the machine as being the last card of one group and the card after it as the first card of the next group. Comparing is illustrated in Figure 17.

Between processing the last card of one group and the first card of the next, the machine goes through a series of steps known as the "total cycle." The total for the group is printed and the form is spaced. The total cycle is activated by the recognition of the difference between groups, the unequal condition resulting from comparison of the same field in successive cards.

The 402 Alphabetical Accounting Machine illustrated is able to perform accumulations of three different levels of totals. For example, it may be desirable to have sales performance figures for each salesman in a company, for each office and for each district. Such a report is possible in one processing of cards through the 402. The lowest (or smallest) category is the total of each salesman. The total for each salesman (the lowest level) is known as the minor total. The next level is the total by office (the sum of salesmen's activity in that office) and is the intermediate total. The district total comprises the total of all offices in the district and is in this case the major total. In addition to these totals a final total may be obtained which gives the sales total for all districts in the company and represents the whole company's activity for the period. Such a report is illustrated in Figure 18. Prior to the preparation of this report on the accounting machine, cards are sorted first by salesman, then by office and then by district.

Three different fields are compared to achieve the proper grouping of data for totals. To get a total by each salesman, the salesman field in cards is compared. To get the office total, the office number field in cards is compared. For district totals the district fields must be compared. It should be noted that when the office number changes, the salesman number does also. When the unequal comparison occurs in office number, the salesman total is printed first and then the office total. When the district number changes, the salesman total prints, the office total and then the district total. Thus three different totals print when the district number changes, the lowest classification first. The ability to accumulate and print three levels of totals increases the power of the accounting machine by eliminating multiple runs.

Counters in the 402 Alphabetical Accounting Machine are of different sizes, in units of two, four, six and eight positions. A two-position counter can total up to 99, a four-position counter 9999, etc. Larger totals may be accommodated by joining counter groups. For example, if a counter large enough to hold a ten-digit total is needed, it may be made from a six-position counter and a four-position counter, two fours and a two, or a six and two twos, or any other combination adding up to ten positions. One total is accumulated per counter grouping.

Counters are able to add or subtract data on the basis of punches in the individual card. As a rule the amounts to be subtracted (credits) are identified as such. The most common way to identify a credit is through an X (11) punch in a specific column of the card containing the credit amount. Cards punched with data to be added would not have the X punch, or credit X. Thus cards are usually added unless otherwise punched. In punching it is easier and faster to identify the few credits by a significant punch than to punch all cards with debit identification.

When accumulating data from a group of cards, the machine is instructed to add or subtract data according to the presence or absence of the significant punch.

While the X punch is the most commonly used method of identifying credits, other punches, such as digits, may also be used.

This ability of the accounting machine to perform an operation based upon the punches in the card is known as "selection." Selection enables the machine to pick the proper course of action for a card depending on the nature of the data punched in it and the instructions given to the machine. One punch in a column may initiate one action while another punch in the same column causes a somewhat different processing of the data.

Figure 16 illustrated a group-printed inventory report which was prepared from a Previous Balance card and Transaction cards. If cards representing new transactions were continually added to the file for processing, the file would soon be unwieldy to process. To keep card volume to a minimum for processing, files are periodically summarized and a New Balance card is created. This may be done at the same time that the tabulation is made. One card may be created which represents the current status. Any transaction in the next period would then be associated with the appropriate balance card prior to running the new inventory report. The New Balance card may be prepared during the preparation of the tabulation by a process known as "summary punching."

Summary punching is the process of punching one card to represent the total of a particular group or classification of data. Summary punching is done by the transfer of totals and indicative, or identifying, data from counters in the accounting machine to a machine which punches the summary card. The machines are connected for this operation by a cable, and the data is transferred prior to printing totals on the report form.

Summary punching is often of value in reducing the number of card passes necessary. If three processing runs must be made to produce various statistics, quite often a summarization may be performed on the first run which will reduce the number of cards to be processed on the next two runs. In cases where cards are referred to visually for information, maintenance of summary cards reflecting account status will reduce error and time by eliminating the mental computation of new balances from Previous Balance cards and Transaction cards.

SALES PERFORMANCE REPORT

DATE: 3/ 31 /

DIST. NO.	OFF NO.	SLSMN NO.	DISTRICT, OFFICE OR SALESMAN	PRODUCT "A"	PRODUCT "B"	PRODUCT "C"	PRODUCT "D"	TOTAL BY SALESMAN	TOTAL BY OFFICE	TOTAL BY DISTRICT
1			NORTHEAST DIST							
	1		BOSTON OFFICE							
		5	J G CARGILL	2316.85	4819.37	3098.17	972.55	11206.94		
		43	A E JOHNSON	4018.61	3627.18	1085.36	2589.02	11320.17		
		77	G I ROSS	4001.35	3869.92	1478.03	1968.45	14620.75		
									37147.86	
	2		NEW YORK OFFICE							
		2	P E AKERS	3213.98	4890.97	1344.45	1861.03	11310.43		
		17	A K DEERING	3544.40	2315.86	3987.03	2932.23	12779.52		
		36	R T INGEBRETSEN	2843.16	3720.10	2815.77	1504.32	10883.35		
		79	F H RUSH	1444.83	2315.16	1591.47	1416.37	6767.83		
		89	T L WESTMORE	2429.76	3402.10	3295.14	2678.01	11805.01		
									53546.14	
										90694.00*
2			MID COAST DIST							
	1		BALTIMORE OFFICE							
		3	B L BARNEY	5584.36	4715.96	3620.93	1926.18	15847.43		
		27	P W GOODE	3231.64	1780.41	4099.82	2078.68	11190.55		
8			SOUTHWEST DIST							
	1		DALLAS OFFICE							
		51	R X MILLER	5028.00	1858.95	2468.31	3769.70	13124.96		
		58	R M NORTH	2338.71	3066.30	3517.89	3010.53	11933.43		
									25058.39	
	2		EL PASO OFFICE							
		56	A R NELSON	5419.02	4380.65	3729.77	4380.91	17910.35		
									17910.35	
										42968.74*
										872106.87* *

Figure 18. A Sales Performance Report

The Control Panel

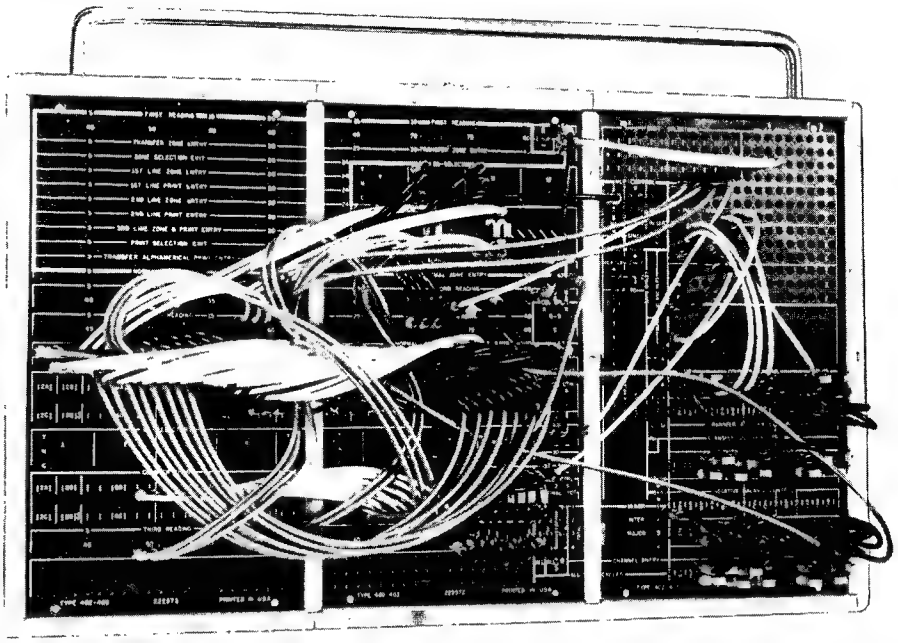

Figure 19. A Wired Control Panel

The accounting machine is instructed to process data by means of a control panel, placed in a rack on the machine and locked into position on the end of the accounting machine. A few of the functions of the control panel are to tell the machine what data to print from cards, where to print it, what to accumulate and by what groups, and when to print the totals. The control panel gives the accounting machine its flexibility, because by changing control panels a new set of instructions for processing data is given to the machine. The control panel makes possible the processing of diverse jobs in unrelated areas calling for various reports.

In each section of the panel there are rows of holes which pass through the panel. In each hole, commonly called a hub, is a metal socket. When the control panel is inserted in the machine each socket on the front of the panel is connected to the internal wiring of the machine. By joining two hubs with special wires, circuits are completed which cause various operations of the machine to be performed. A control panel, with wires inserted, is illustrated in Figure 19.

Some of the hubs are connected to typebars which do the printing, others are connected to counters which will accept data for addition or subtraction and still other hubs are connected to cause machine functions. As cards feed into the accounting machine, the 80 columns are read simultaneously by separate reading brushes. Each brush in turn is connected to a hub on the control panel. In order to print the data in a card column, the impulse created in reading the column is directed to one of the typebars by connecting the hub from the reading brush with the hub connected to the typebar. The completion of this circuit causes the character in the column to be printed on the report. Figure 20 illustrates internal and external wiring which will cause printing.

For example, by joining the hub from reading brush 56 (which reads card column 56) to the hub connected internally to typebar 3, the data in column 56 of the card is printed on the report in the location in front of typebar 3. In a similar fashion, data may be directed to counters for addition or subtraction, or to a hub which will cause a machine function, such as forms spacing or forms skipping. In each case a circuit is completed by a wire put in the control panel to connect two hubs.

The process of preparing the control panel for use is known as control panel wiring, or board wiring. Prior to any wiring, the job must be planned. The purpose of the accounting machine is to process available data and put it in a form desired by management. The first step is to determine the format of the report, consistent with available data. Once the report is designed, the control panel is wired, taking into account the design

of the report and the layout of the card. The sequence of data on the report does not have to conform to the sequence of data in the card. If the data in columns 75 to 80 in the card is to be printed by typebars 1 to 6, the hubs from the reading brushes for columns 75 to 80 are each connected by a wire with the hubs for typebars 1 to 6.

Once the panel is wired and the cards are in sequence, the particular report is prepared by inserting the control panel in the machine, taking the few necessary setup steps, putting the cards in the feed hopper and pushing the start button. Thus the accounting machine is able to process completely different reports with a minimum of time spent in setup, making more machine time available for processing. Control panels for regularly prepared reports are usually wired once and held for subsequent use.

The ease of wiring control panels facilitates the preparation of special reports when desired by management. As needed, and dependent upon the availability of data in cards, reports may be prepared quickly to meet special or changing requirements.

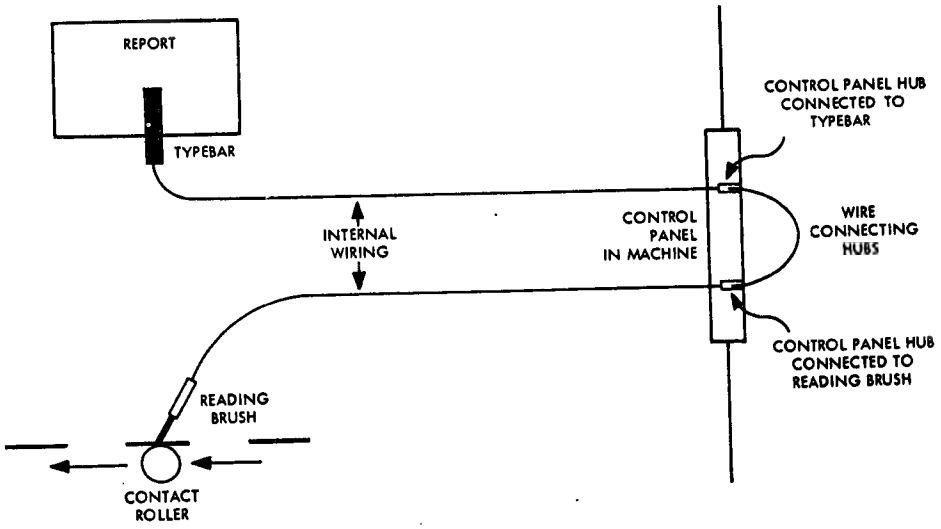

Figure 20. The Internal and External Wiring to Cause Printing

Accounting Controls

Accompanying any accounting system are safeguards to insure the accuracy of all data in the system and to insure the presence of all pertinent information. These safeguards are known as "controls." Controls are also an integral part of the successful application of IBM machines and methods to accounting. Controls not only provide accuracy of data but permit easier audit by providing a clear and concise audit trail by which transactions may be traced back from end to beginning.

Accuracy of conversion of source data to IBM punched cards is assured by verification. Next, a register is prepared on the accounting machine, a complete listing of all data punched into the cards. Then totals which accompany the source data are compared to totals on the register. The data totals are entered into the system of controls.

Accounting totals maintained throughout processing assure the accuracy and completeness of data. Comparisons of totals on reports with control figures should signify correct results. If the comparison indicates missing data, standard procedures facilitate swift referral to the original register, from which the data may be repunched and returned to the system. When normal care is taken in the handling and processing of the cards in which the data is punched, loss of data is rare. Controls are designed to assure the completeness and accuracy of reports upon which management decision is made.

Other Punched Card Machines

A basic installation of IBM machines normally consists of a card punch, a sorter and an accounting machine. The IBM 26 Card Punch, 82 Sorter and 402 Alphabetical Accounting Machine are typical of these machines. In addition to the three basic types, machines in other categories were developed to meet various data processing needs. Each category includes more than one machine of different speed and capacity.

Collators are machines designed to match (compare) fields of data in two card groups for equality, to merge two groups of cards on the basis of the data in them, to select cards punched with specific data, and to sequence-check a file of cards to insure correct ascending or descending order. A combination of these functions may be performed at the same time. Cards enter the collator from two separate feeds.

For many reports, data in two sets of cards must be combined. The Inventory Transaction Listing illustrated in Figure 15 was prepared from Previous Balance cards and Transaction cards. One set of cards was placed in one feed, the second set in the other, and the Transaction cards were merged behind appropriate Previous Balance cards. Each feed operates at rates of speed from 120 cards per minute to 650 cards per minute, depending on the model of the collator.

Calculators are machines able to perform addition, subtraction, multiplication and division. Information punched in a card is read into the calculator where computations are made. A series of mathematical steps may be performed in one processing and the results punched into the same card. For example, an employee's payroll information may be read from the card into the machine, all taxes calculated and the net pay determined. All taxes and the net pay may then be punched into the card. Processing takes place at speeds up to 200 cards per minute.

Interpreters print on a card data punched in it. Either alphabetic or numerical data may be printed in any desired sequence. One line at a time is printed at speeds up to 100 lines per minute. Normally interpretation appears at the top of the card, although the 557 Alphabetic Interpreter can print on any of 25 lines on the card. Cards are usually interpreted when visual reference may be required to data punched in the card.

Reproducers are machines designed to perform three basic functions: reproducing, gang punching and summary punching. Reproducing is the process in which data in one set of cards is machine-read and punched into another set of cards. Reproducers have two separate feeds, one called the read feed and the other the punch feed. Cards to be reproduced are placed in the read feed of the machine. Blank cards in which the data is to be reproduced are placed in the punch feed. The machine reads a card with data in it, transmits the data to the punching mechanism where it is punched into a blank card. After punching, the data read and the data punched may be compared to assure the accuracy of the reproduction. Some or all of the 80 columns of data may be reproduced and the sequence of the data may be changed. Reproducing is done at speeds up to 100 cards per minute.

Gang punching is the process of duplicating data from one card in a group to the next. Data in a card is read, punched in the card behind it, which in turn is read and the data punched in the next card. For example, it may be desirable to have a date punched into a group of cards. The date need be punched manually in the first card only. The group of cards is placed in the punch feed of the reproducer. The data is read from the first card and punched into the second, read in the second card and punched in the third, and so forth through the group. Either entire cards or parts of them may be gang-punched at rates of speed up to 100 cards per minute.

Summary punching is the process of punching one card to represent the total of a particular group or classification of data. Summary punching may be done by the transfer of totals and identifying data from counters in an accounting machine to a reproducer which punches the summary card. The two machines are cable-connected for this operation. Prior to printing, totals are transferred to the reproducer where blank cards in the punch feed are punched with the data.

In the same category with reproducers are the summary punch machines which are able only to summary-punch and gang-punch. They have just the punch feed and are unable to reproduce cards.

In addition to the categories of machines mentioned, there are others which are composed of machines designed for more specialized use, such as statistical machines, paper tape processing machines, card transmission equipment and typewriter output machines. There are others too which do not fit into categories but have been designed to fulfill specific data processing needs.

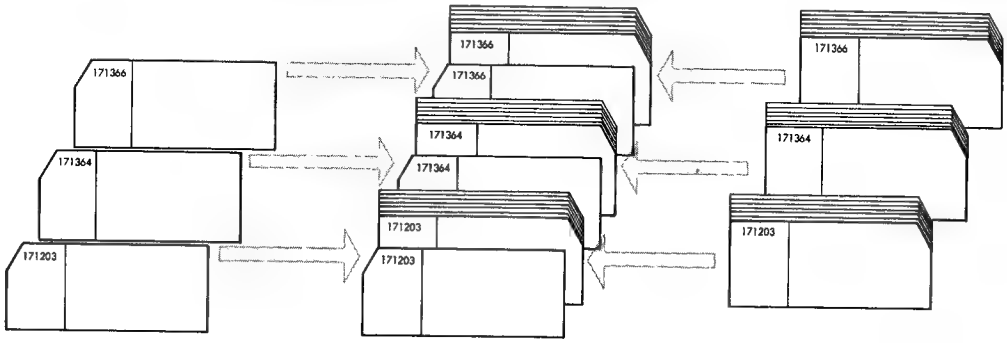

Figure 21. An Example of Merging

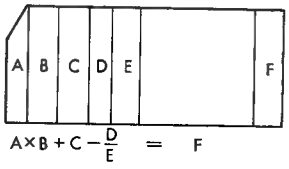

Figure 22. An Example of Calculating

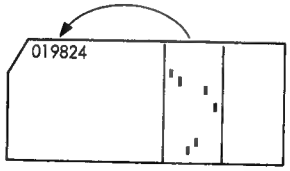

Figure 23. An Example of Interpreting

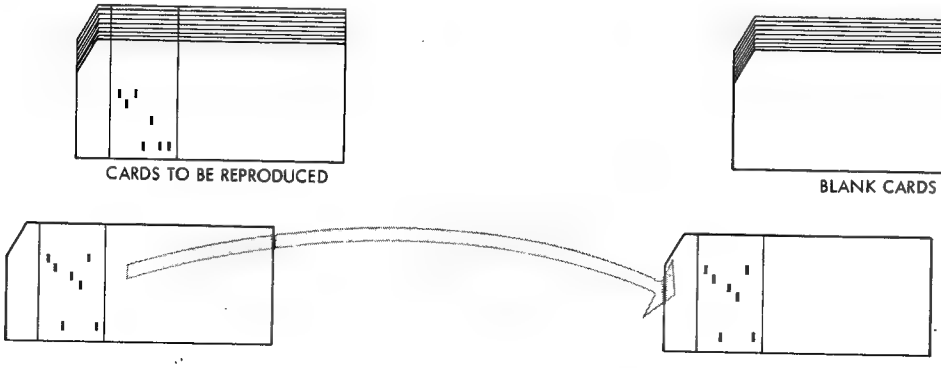

Figure 24. An Example of Reproducing

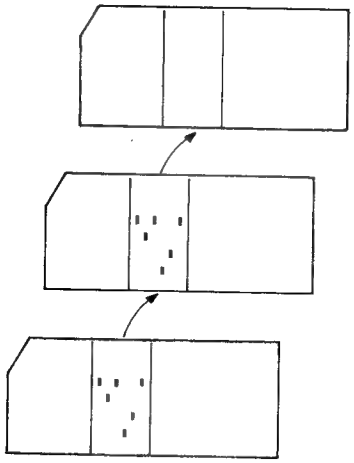

Figure 25. An Example of Gang Punching

The Use of Prepunched Data

To take advantage of the fact that much information processed is of a repetitive nature, data is "prepunched" into cards as much as possible. Prepunched cards are cards which have been punched manually once, verified for accuracy and then reproduced for later use as needed. For example, a company which sells products must print the customer's name and address and the products sold on a bill every time a sale is made. Cards prepunched with the name and address of the customer may be removed from a file and used in preparing the bill. Punching and verifying the name and address each time is thus eliminated.

The same process may be performed with cards containing the product data which must appear on the bill. A card is punched manually once and verified with such product information as product code, product description, sales price, weight and warehouse location. The card is reproduced mechanically in needed numbers. When a customer orders the product, a card is removed from the group and only the quantity is manually punched. Sales amount (quantity times unit price) is automatically calculated and punched into the product card. The name and address cards and product cards then prepare the bill. In such a case manually punched information often amounts to less than 10% of all punched data.

Prepunching data in cards assures the accuracy of the data because the information punched once and verified is automatically reproduced and is automatically checked at machine speeds. In addition, removing prepunched cards from a file is normally faster and less expensive than punching and verifying the same data.

Glossary

Card Column—One of the 80 vertical divisions of a card, normally accommodating one letter, digit or special character. Each column contains 12 punching positions.

Coding—Assignment of letters, digits or both to identify or classify data.

Collating—Interfiling two sets of cards in sequence.

Comparing—Examination of fields (usually in two cards) for equality of data punched.

Control Panel—The removable device which contains external wiring to cause data to be processed in the desired fashion.

Detail Printing—The printing of one line of data from each card passing through the accounting machine.

Duplication—The automatic punching of data from one card into the next, normally performed on a card punch.

Field—A column or columns reserved for the punching of data of a specific nature.

Gang Punching—Duplicating data from the first card in a group to the cards behind, usually performed in a reproducer.

Grouping—The arrangement together of data of the same classification.

Group Printing—Machine summarizing of a group or groups of cards with one line printed for each group's totals and identifying data.

Interpreting—Printing on a card data punched in it.

Listing—See "Detail Printing."

Merging—Interfiling in sequence two sets of cards.

Punching Position—One of the 12 divisions of a card column, into which a hole may be punched.

Punching Station—On a card punch, the place where holes are punched into the card.

Reading—Converting punched holes into electrical impulses.

Reading Station—On a card punch, the place where the holes punched into the card may be read.

Reproducing—Punching data from one set of cards into another set of cards.

Selecting Data—The extraction of a desired item or items of data from a larger group of data. Sorters and collators are used in selecting data.

Selection—The ability of a machine to perform an operation based upon what is punched in a card. Almost all IBM machines have the ability of selection.

Sequencing—Arranging data into a predetermined order.

Source Document—The original paper on which are recorded the details of a transaction.

Summary Punching—The automatic process of punching one card containing data summarized from a group of cards.

Tabulating—See "Group Printing."

Verification—Checking for accuracy what is punched in a card with data on the source document.

Zone Punch—One of the top three punching positions in a card column (12, 11 or X, and 0).

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IBM

International Business Machines Corporation

Data Processing Division

112 East Post Road, White Plains New York

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DATA-PROCESSING

machine functions

[redacted]

INTERNATIONAL BUSINESS MACHINES

25X1A

Data Processing Division
112 East Post Road
White Plains, New York
Printed in U.S.A.
224-8208-3

IBM DATA PROCESSING machine functions

THIS BOOKLET shows in simplified form the functions of the many IBM machines used for all types of accounting, statistical, and computational work. IBM machines can perform such functions as:

reading
checking
coding
duplicating
filing
arranging
sorting
posting
copying
searching
comparing
counting
computing
listing
summarizing
printing
document writing

For needed uniformity in machine-processing the great variety of sizes, contents, and arrangements of records, information is transcribed into a unit record. The IBM card is this unit record, and holes punched in the cards represent the information to be processed. After it is once punched and verified, the unit record can be automatically processed through IBM machines to produce finished reports.

Various methods of punching data into IBM cards, and the functions performed by IBM machines in processing the cards and data, are listed by page number.

contents

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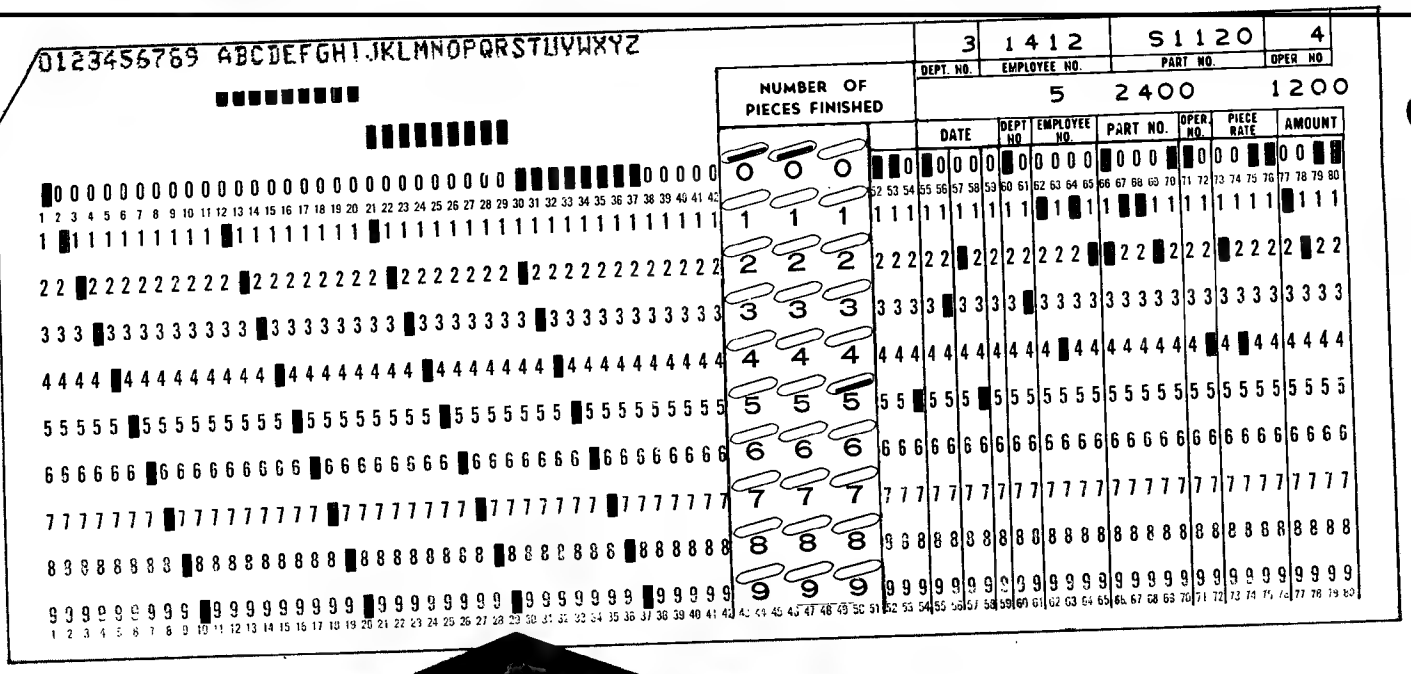


WHAT THE PUNCHED HOLE WILL DO

1. It will add itself to something else.
2. It will subtract itself from something else.
3. It will multiply itself by something else.
4. It will divide itself into something else.
5. It will list itself.
6. It will reproduce itself.
7. It will classify itself.
8. It will select itself.
9. It will print itself on the IBM card.
10. It will produce an automatic balance forward.
11. It will file itself.
12. It will post itself.
13. It will reproduce and print itself on the end of a card.
14. It will be punched from a pencil mark on the card.
15. It will cause a total to be printed.
16. It will compare itself to something else.
17. It will cause a form to feed to a predetermined position, or to be ejected automatically, or to space from one position to another.

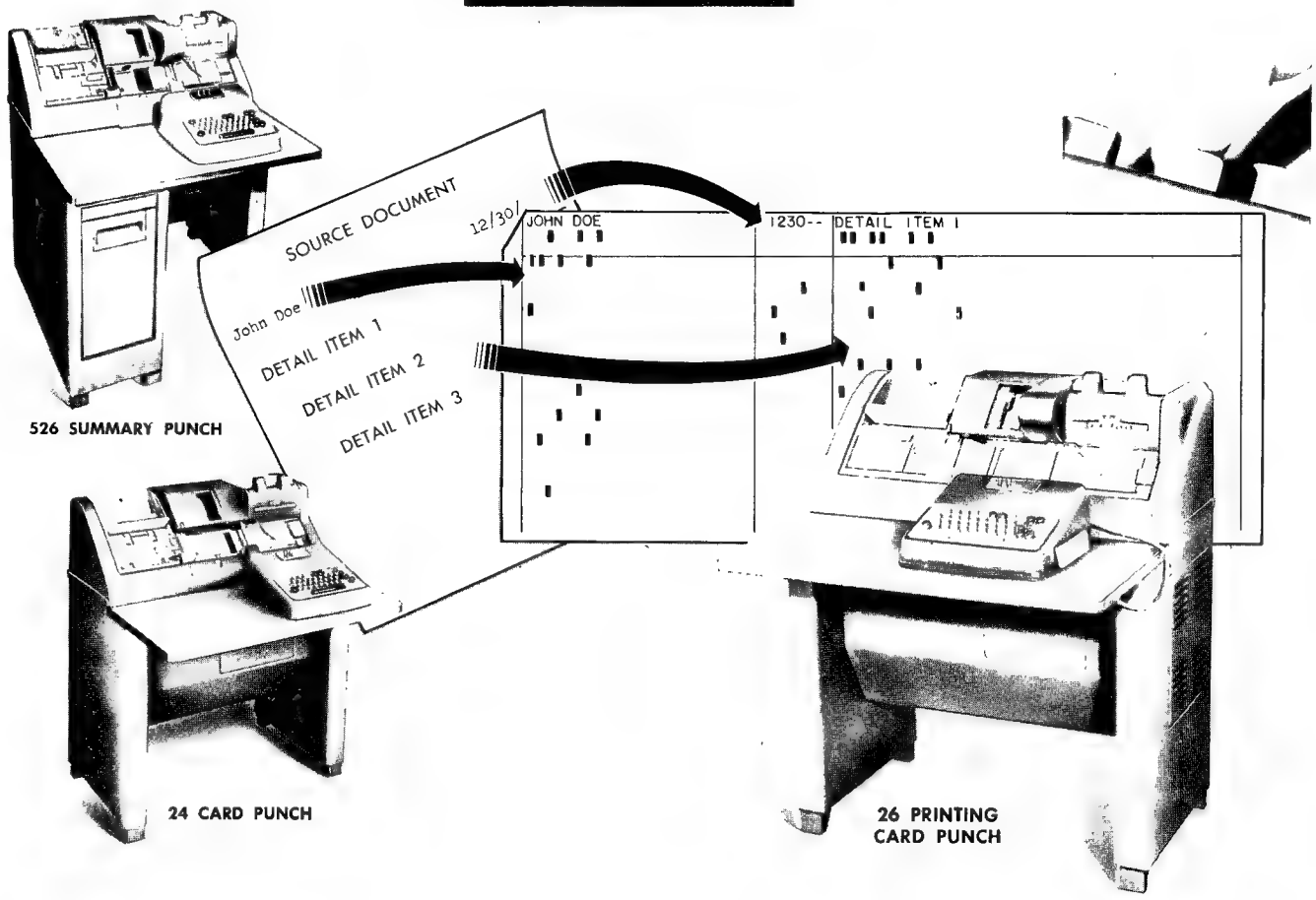
The IBM Card demonstrates the first step in IBM Accounting.

The IBM card has 80 vertical columns. Each column will accommodate a hole (or holes) representing a single number or letter. Information to be included in the card is determined by the requirements of the final reports and documents.

Data to be processed through IBM machines must be punched in the card according to a standard arrangement. Consequently, columns on the card are grouped, and reserved for the recording of each fact about a business transaction.

An IBM card—once punched and verified—is a permanent record. It can then be read by machines to do transcribing and other processing at high speed.

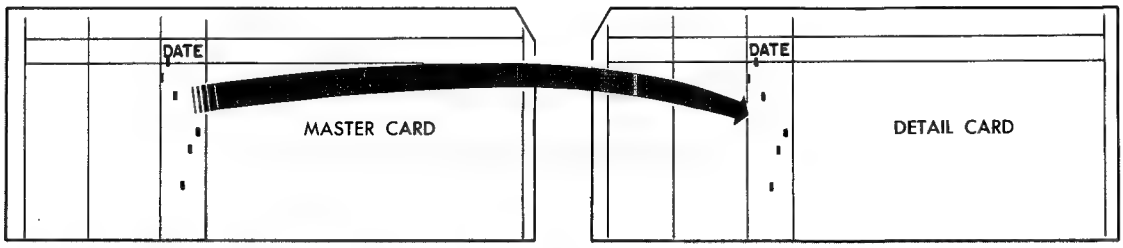
CARD PUNCHING

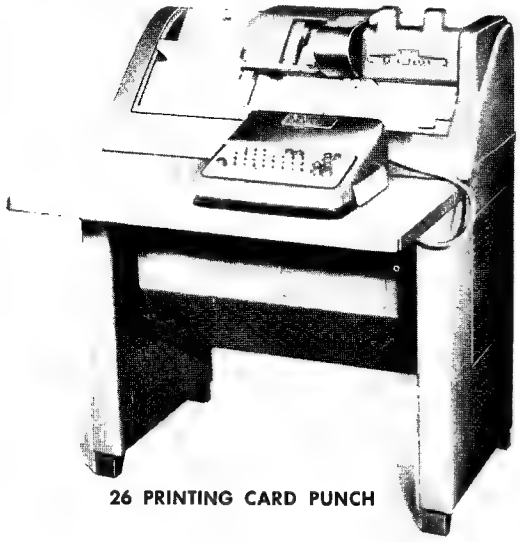


CARD PUNCHING is the basic method of converting source data into IBM punched cards. The operator reads the source document and, by depressing keys, converts the information into punched holes. The machine feeds, positions, and ejects the card automatically. The operator's primary concern is to depress the proper keys in the correct sequence.

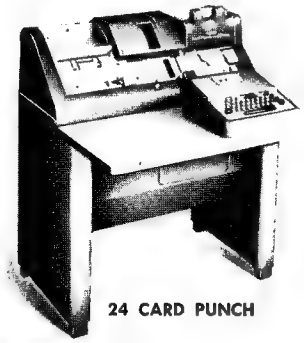
This is basically the same kind of function as typing or other key-driven operations. Card punches equipped with printing mechanisms automatically interpret the punched information at the top of the card directly above the hole being punched.

DUPLICATING

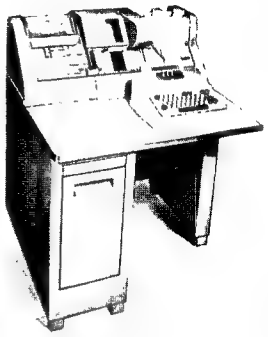




26 PRINTING CARD PUNCH



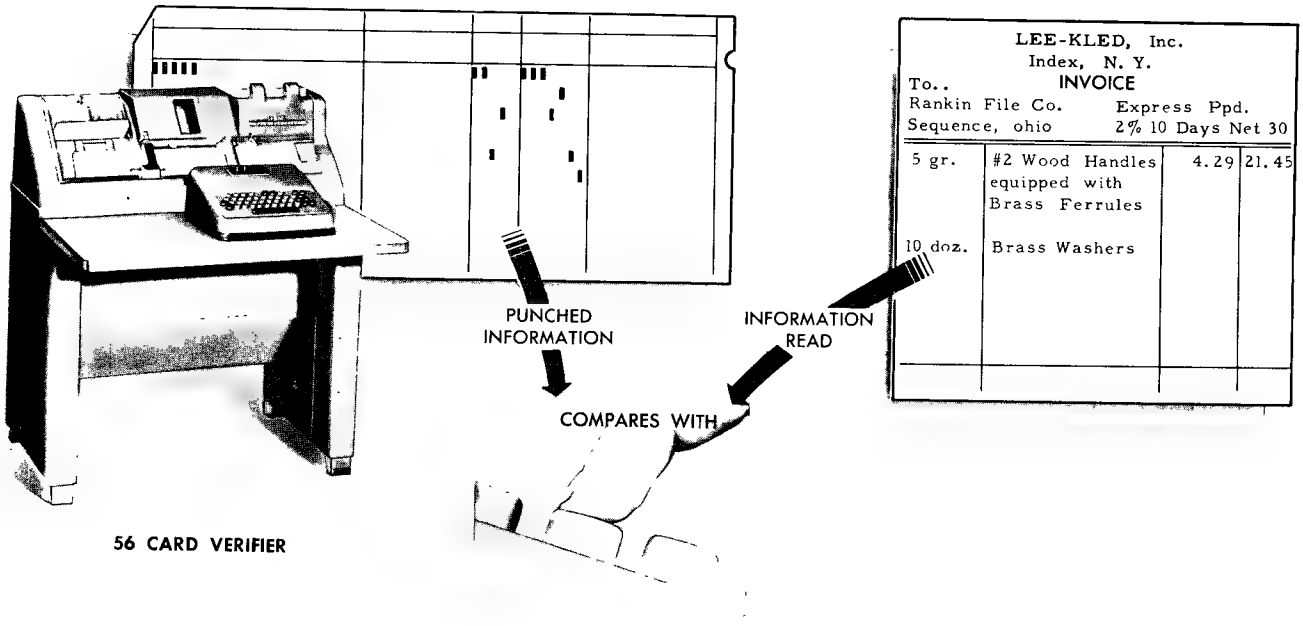
24 CARD PUNCH



526 SUMMARY PUNCH

DUPLICATING is automatic punching of repetitive information from a master card into a group of succeeding detail cards. This is normally performed as part of the card-punching function. Instead of depressing keys repetitively for common information (such as ENTRY DATE, which is to be punched in every card), the operator punches the common information only once in the first card of each group, and it is automatically punched into all remaining cards for the group. This reduces the work per card, insures consistency of common data, and increases productivity of the operator.

CARD VERIFYING



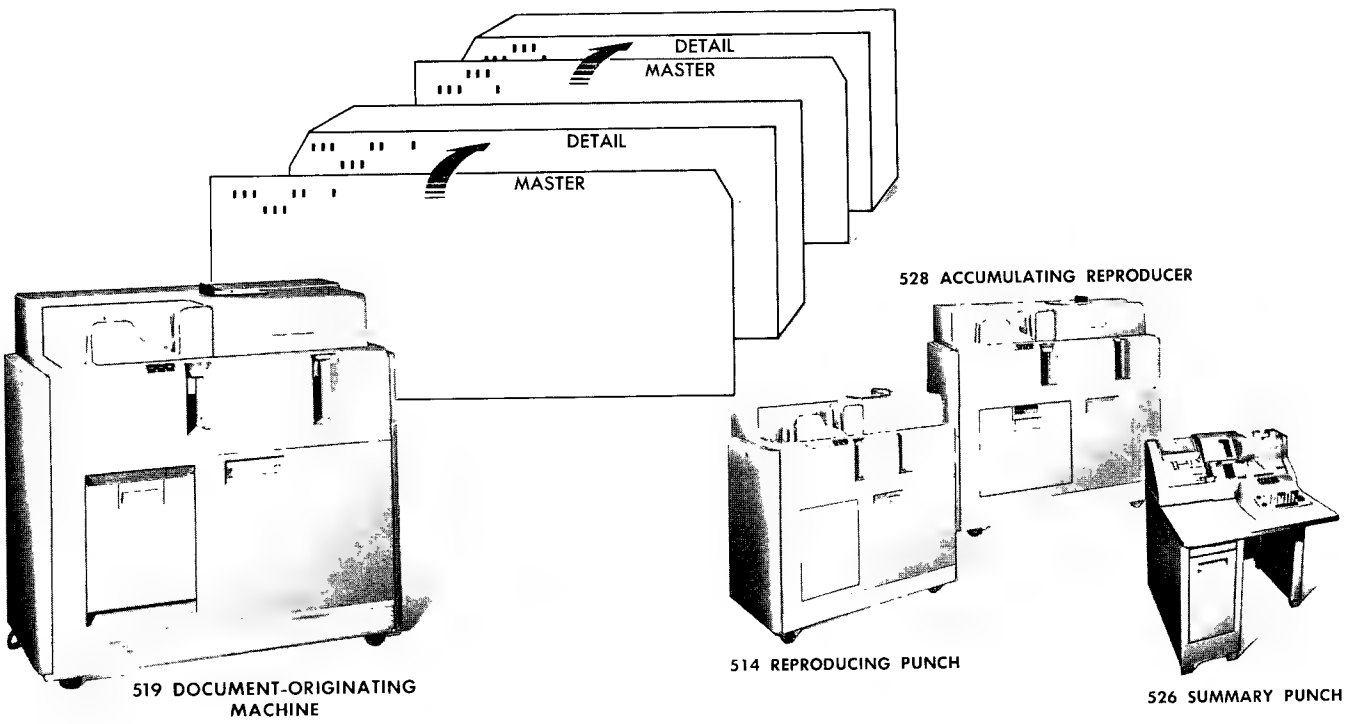
56 CARD VERIFIER

CARD VERIFYING is simply a means of checking the accuracy of the original key punching. A second operator verifies the original punching by depressing the keys of a verifier while reading from the same source data. The machine compares the key depressed with the hole already punched in the card. A difference causes the machine to stop, indicating a discrepancy between the two operations.

A notch in the upper right edge of the card indicates that it has been key punched and verified correctly. A notch directly above a column signifies that the punching of that column is in error.

This is basically the same type of function as typing or other key-driven operations.

GANG PUNCHING



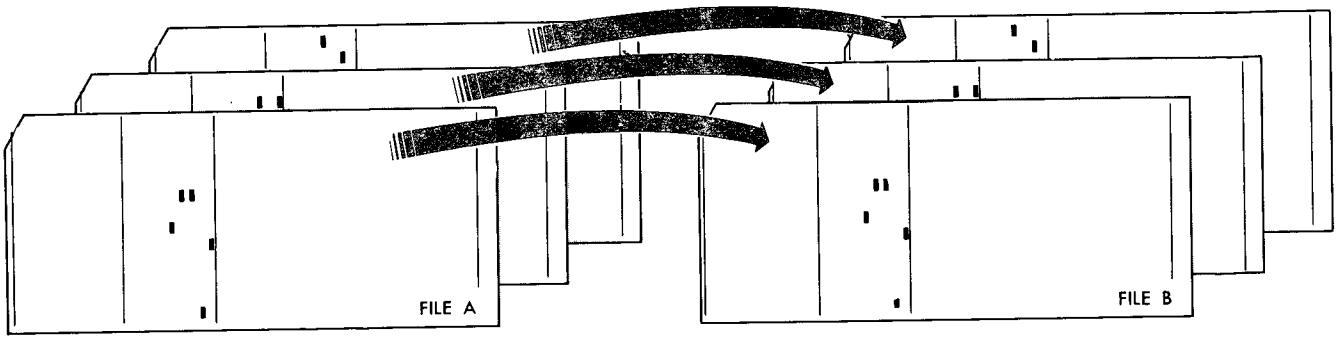
GANG PUNCHING is the automatic copying of punched information from a master card into one or more detail cards that follow it.

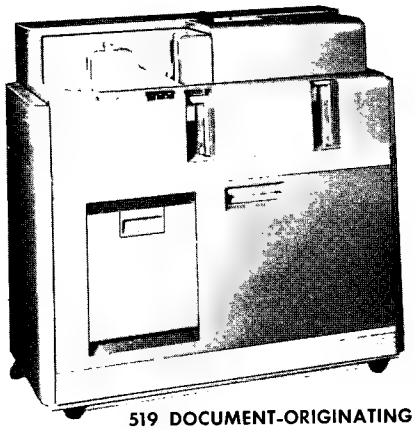
In single master-card gang punching, one master card precedes all detail cards to be punched with the same information.

Where information changes from one group of cards to the next, interspersed gang-punching methods may be used. A master card precedes each group of detail cards. Information in the master card is automatically selected for punching into all following detail cards until a new master is read. The punching pattern then changes to conform with the new master.

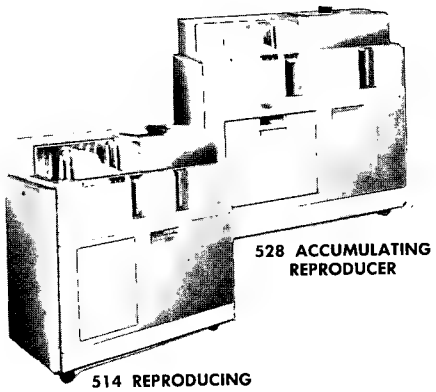
Gang punching can be performed separately or in combination with reproducing and summary punching for both alphabetical and numerical information.

REPRODUCING





519 DOCUMENT-ORIGINATING MACHINE



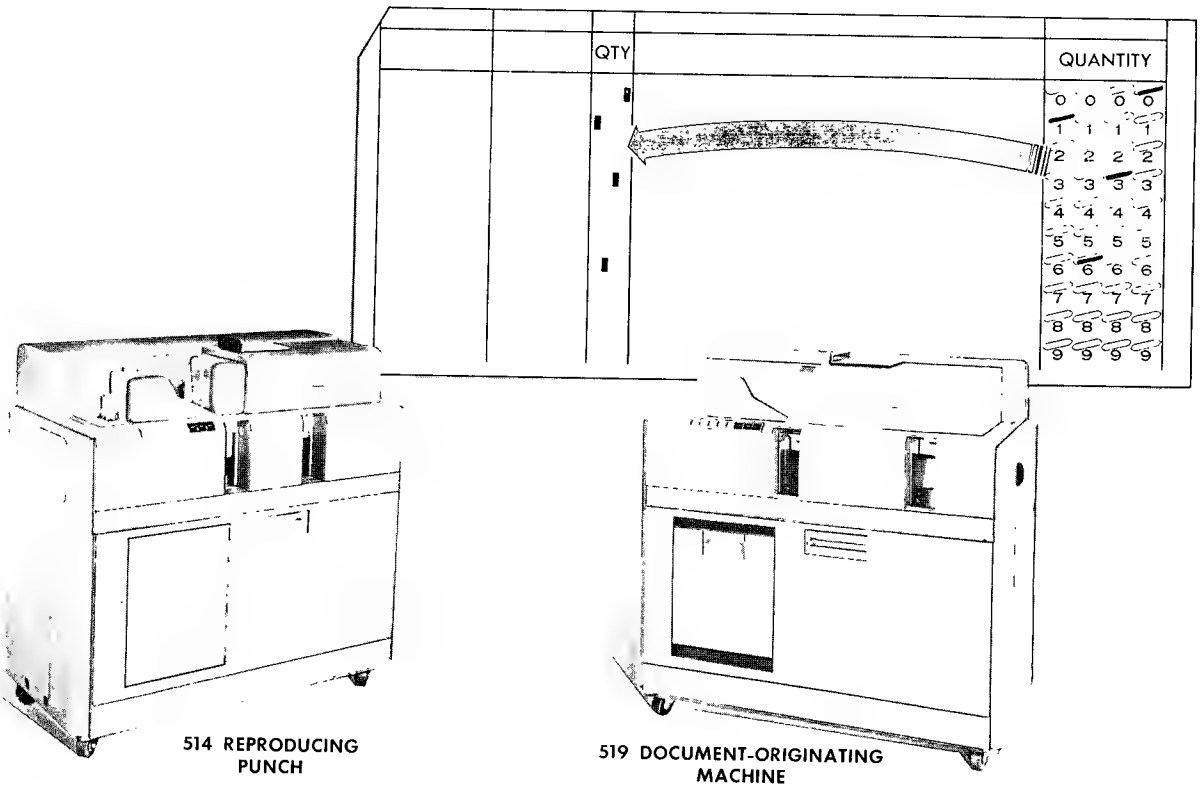
528 ACCUMULATING REPRODUCER

514 REPRODUCING PUNCH

REPRODUCING from one card to another is like copying from one record to another. Information from one set of punched source cards is automatically punched into another set of cards. The two sets of cards are fed through the machine synchronously.

The comparing feature proves agreement between originals and reproductions. Differences are automatically indicated.

MARK-SENSED PUNCHING



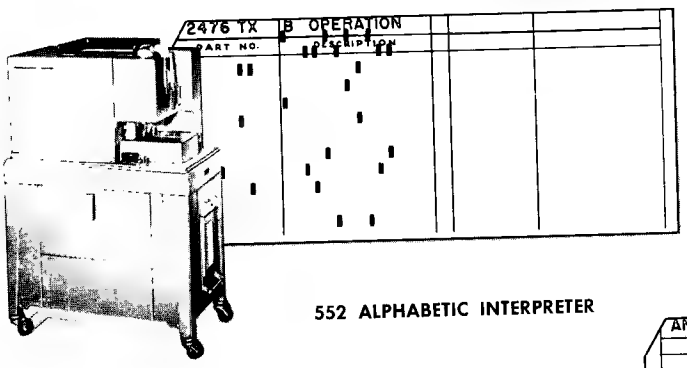
514 REPRODUCING PUNCH

519 DOCUMENT-ORIGINATING MACHINE

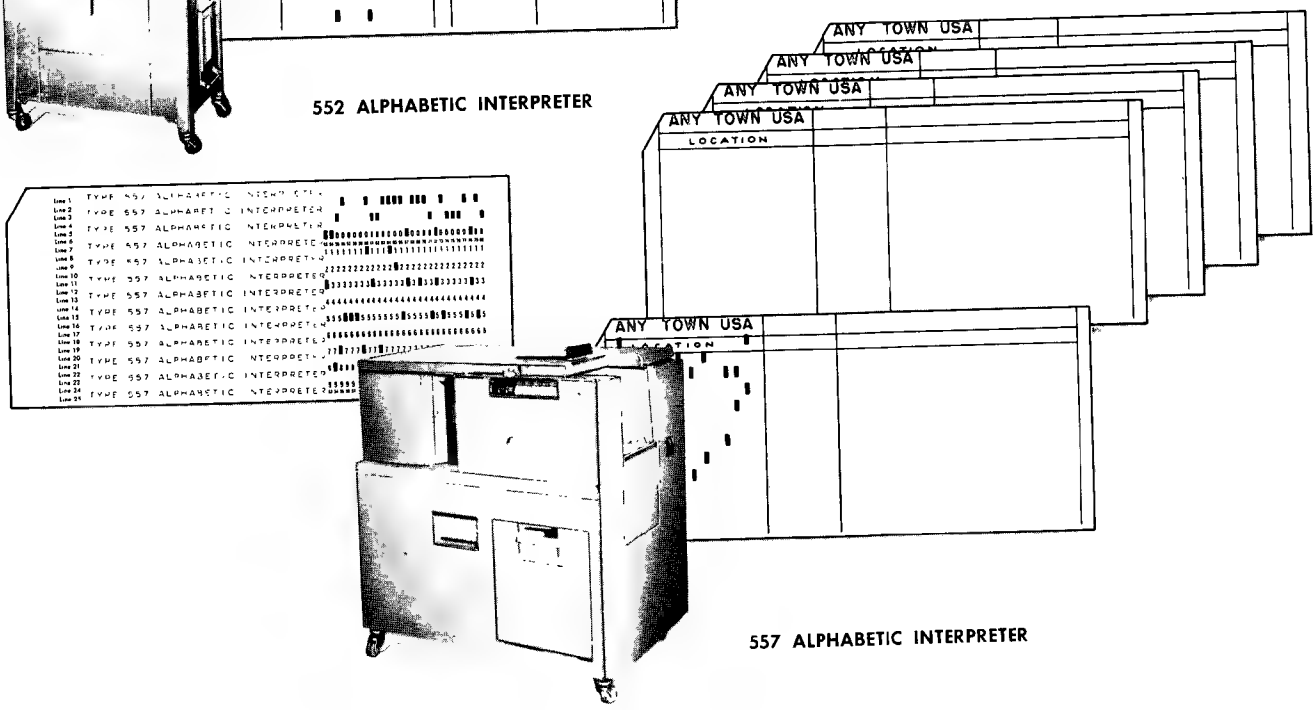
MARK-SENSED PUNCHING is the automatic punching of a card by means of electrically-conductive marks made on the card with a special pencil.

Thus, original facts may be recorded anywhere—in the office, plant or field, by workmen, timekeepers or field workers—and these facts are translated directly into punched-hole form.

INTERPRETING



552 ALPHABETIC INTERPRETER



557 ALPHABETIC INTERPRETER

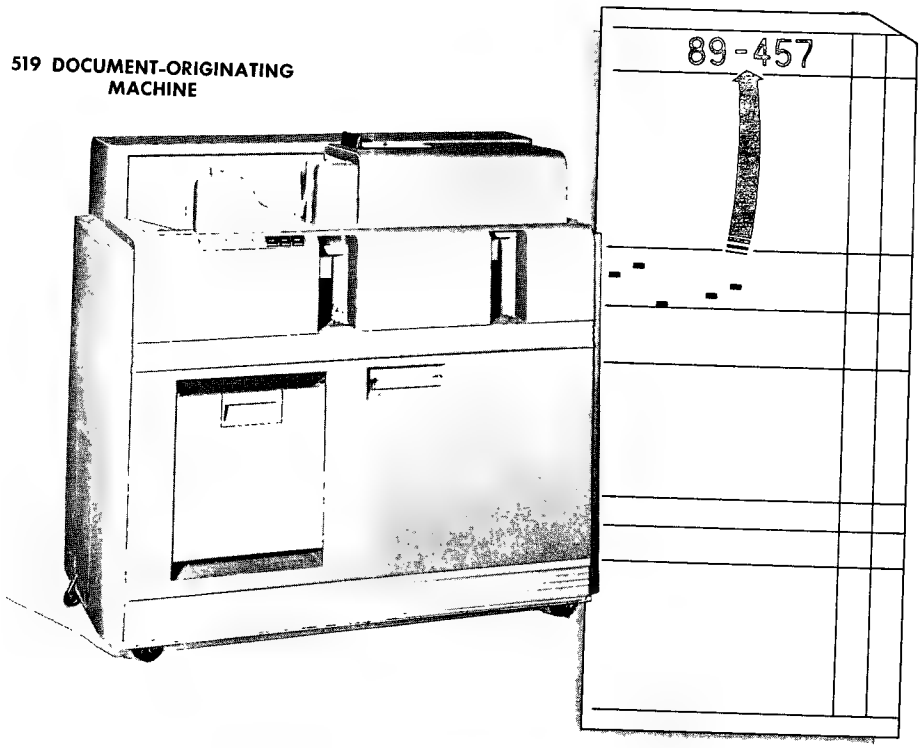
INTERPRETING is the translation of punched holes into printed information on an IBM card.

Alphabetic or numerical information can be printed in many different positions on the same card from which it is read. Common data can be repetitively printed on a group of detail cards from punched information on a master card.

Interpreting is advantageous when punched cards are used as documents on which additional information is written or marked, or wherever reference to filing operations is involved.

END PRINTING

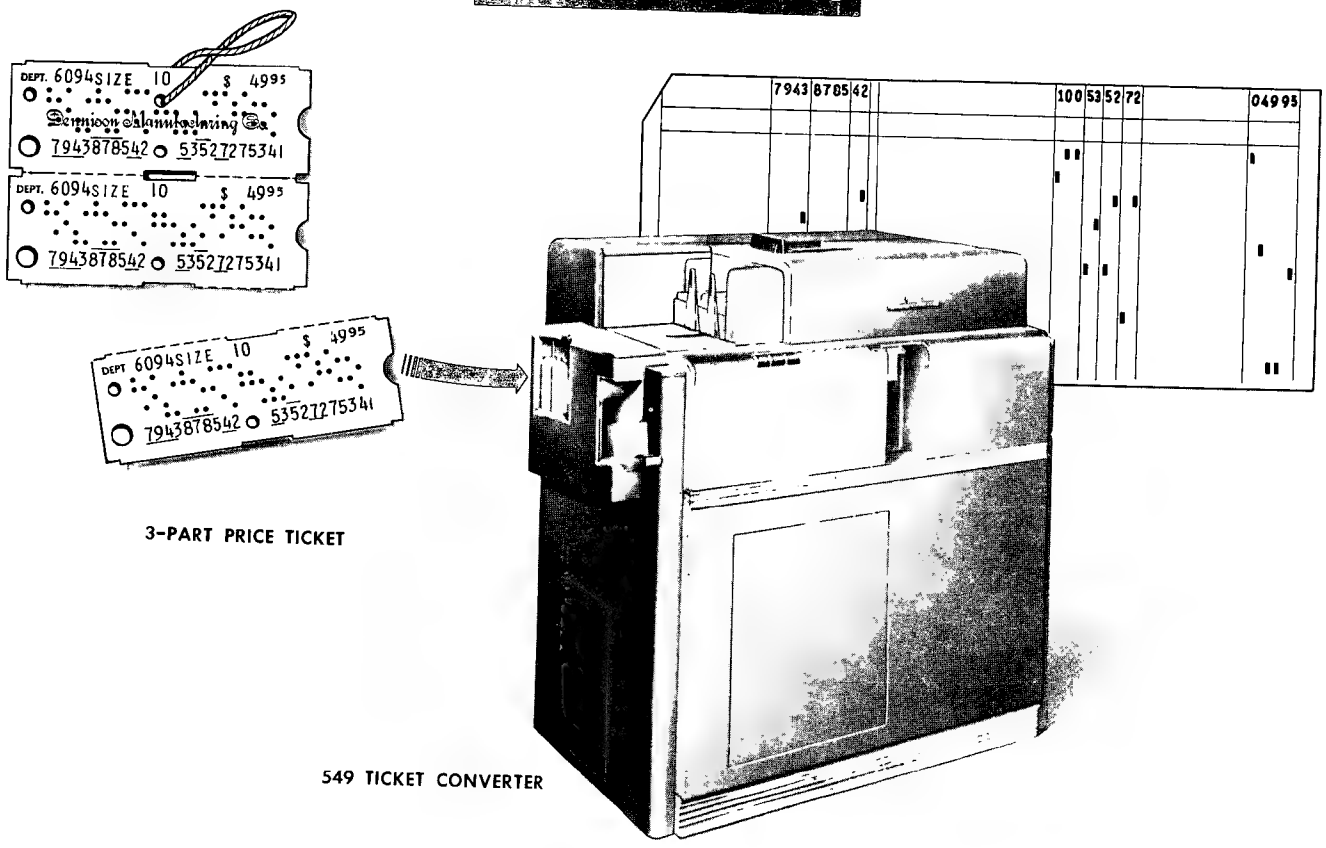
519 DOCUMENT-ORIGINATING MACHINE



END PRINTING converts punched information into bold printing across the end of the card simultaneously with gang punching, summary punching, reproducing, and mark-sensed punching. This is similar to interpreting, and makes possible quick reference to the card.

Cards are printed in this manner for use in prepunched files where cards are stored on end, or in attendance-card racks for convenient reference and selection.

TICKET CONVERTING



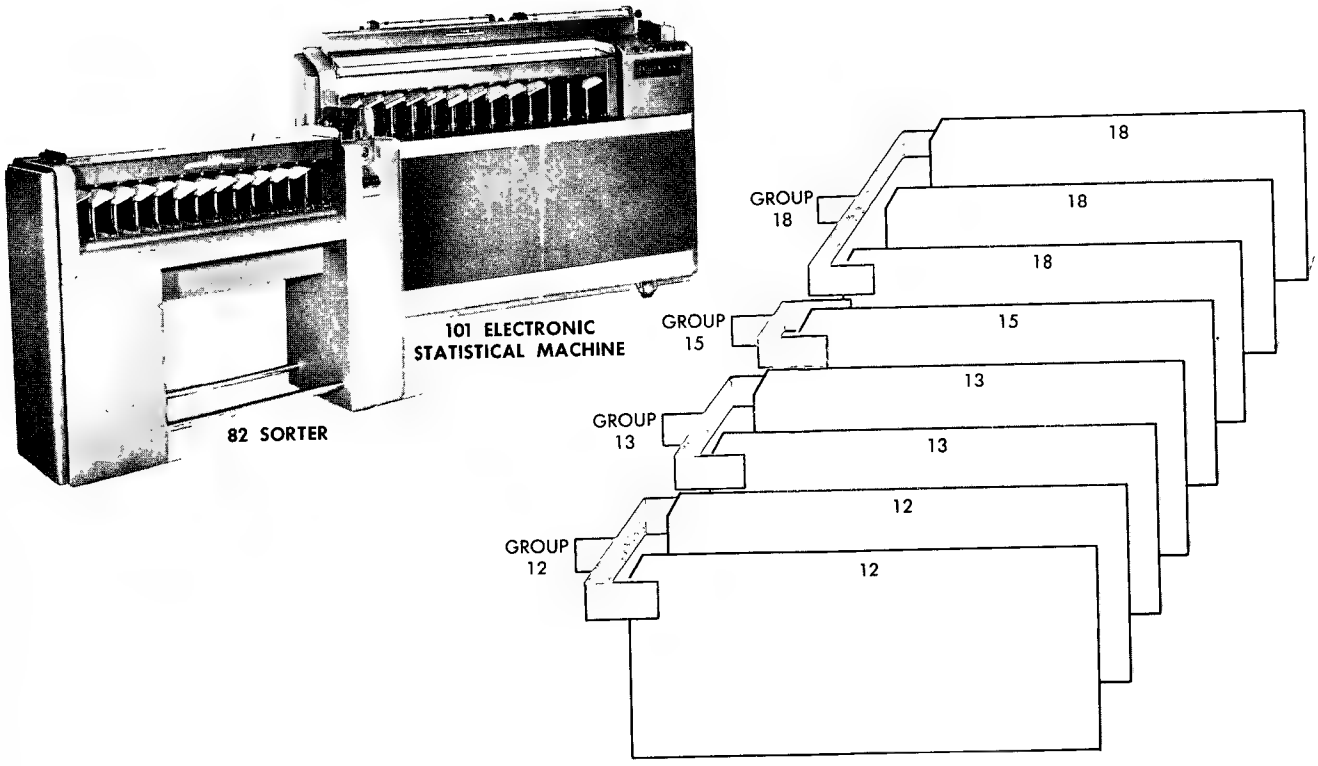
3-PART PRICE TICKET

549 TICKET CONVERTER

TICKET CONVERTING is the process of changing prepunched ticket stubs (2.7″ wide by 1″ deep) into IBM cards. The ticket is made up of a basic section and one or more stubs that are numerically prepunched and printed with identical information.

When a transaction occurs, a stub is detached from the ticket and put into a receiver; the receiver is then placed directly in the ticket converter. The ticket stubs are fed from the receiver, and IBM cards are punched with the corresponding information. A typical application of the ticket converter is in merchandising where price tickets often represent the greatest volume of transactions.

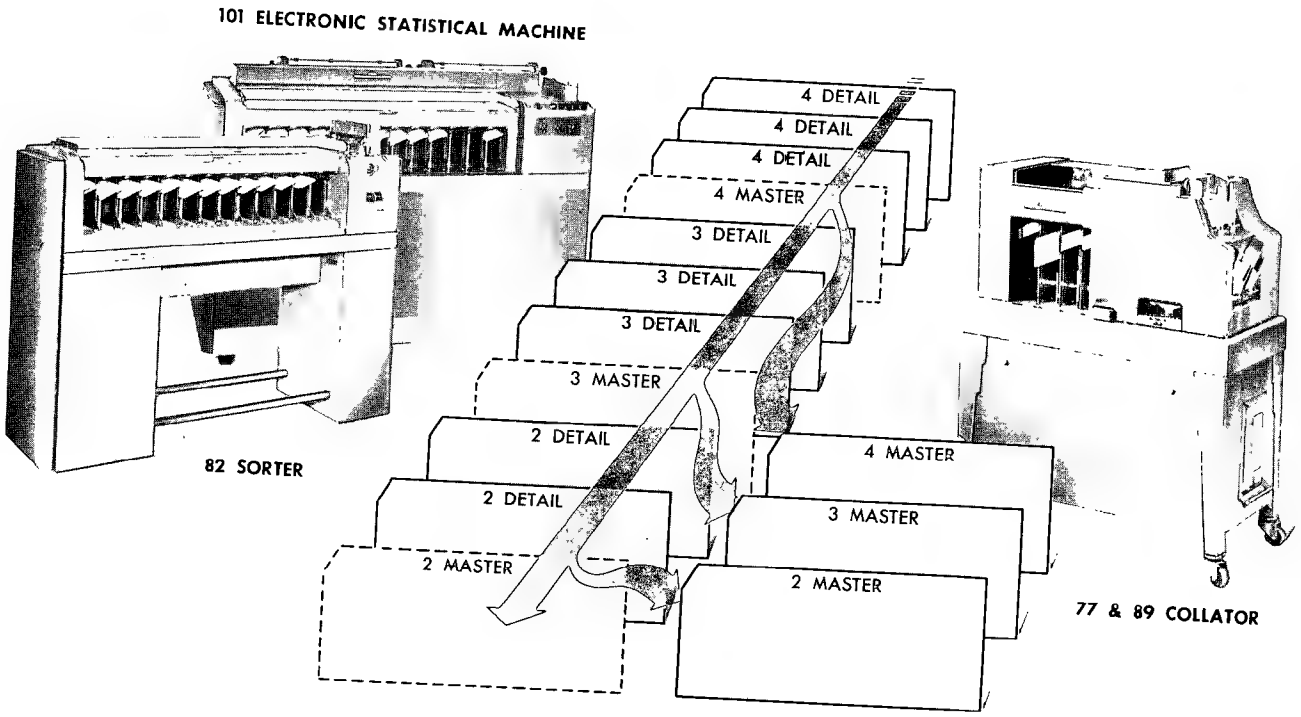
SORTING



SORTING is the process of grouping cards in numerical or alphabetical sequence according to any classification punched in them. To group cards by account, for instance, they are sorted into account sequence. This makes possible summarizing the cards by account.

A fast, automatic machine process thus is provided for arranging cards for the preparation of various reports—all originating from the same cards, but each requiring a different sequence or grouping of information.

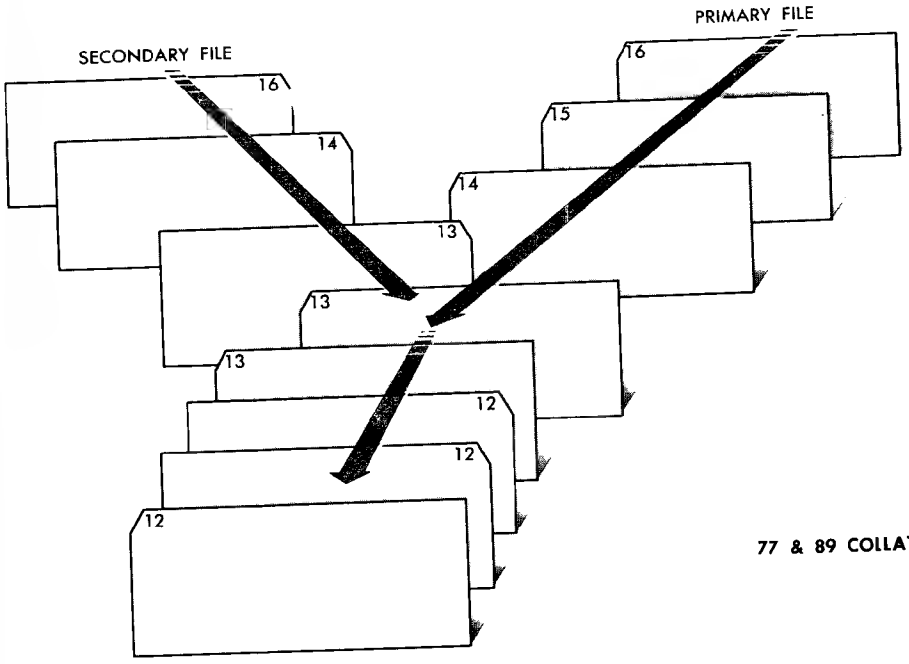
SELECTING

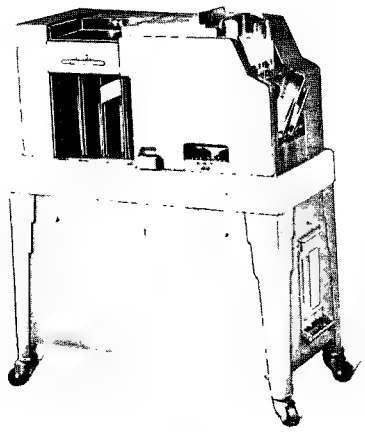


SELECTING is the function of pulling from a mass of data, certain items that require special attention. Selection of individual cards is accomplished automatically by either the sorter or collator, according to the type of selection. Typical selections are:

Cards punched with specific digits
Certain type of cards for a specific date
All cards containing a specific number
All cards higher than a specific number
All cards lower than a specific number
Cards between two specific numbers
First card of each group
Last card of each group
Unmatched cards
Cards out of sequence

MERGING



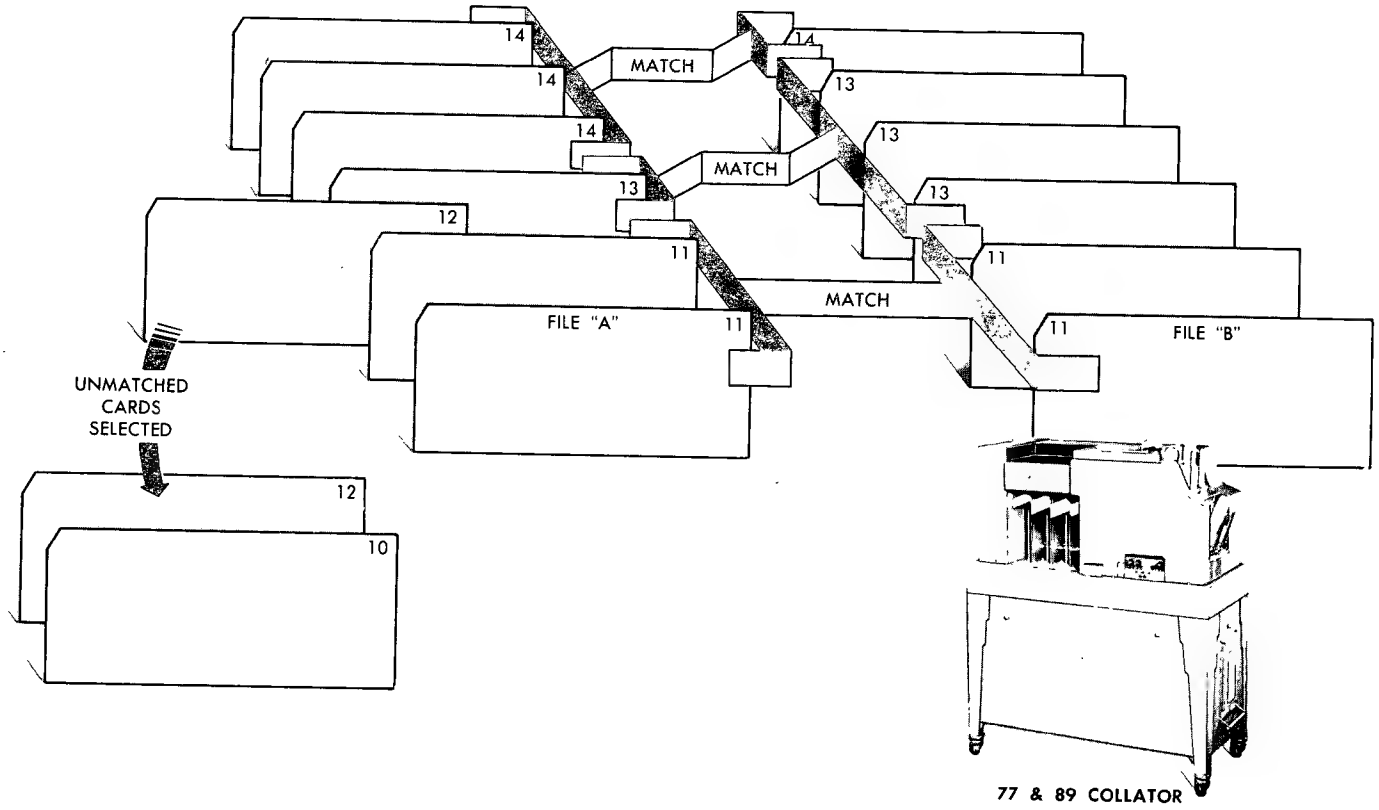


77 & 89 COLLATOR

MERGING is the combining of two sets of punched cards into one set of given sequence. Both files of cards must be in the same sequence before they are merged.

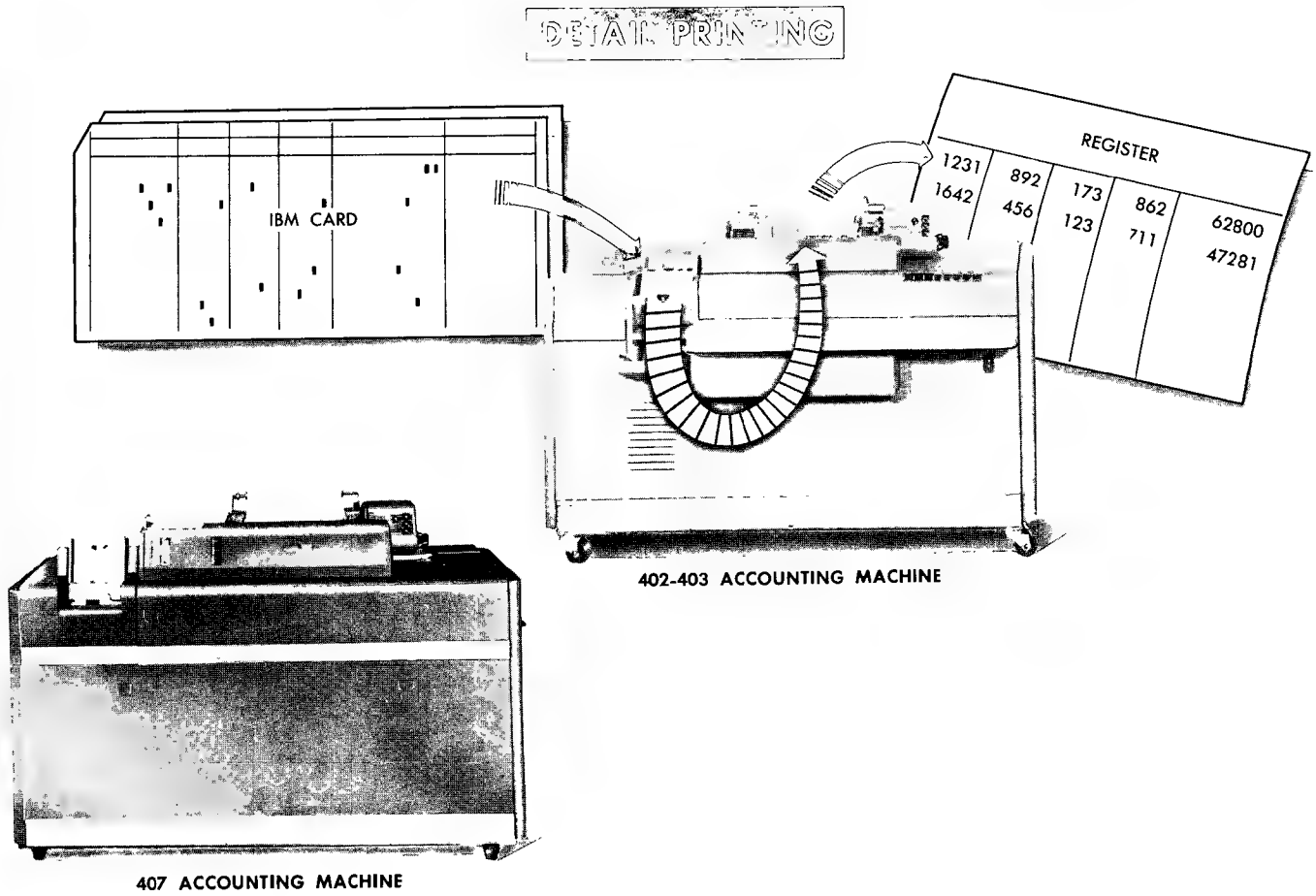
This function makes possible automatic filing of new cards into an existing file of cards. It is a faster method than sorting to use in placing related cards together.

MATCHING



MATCHING is a checking function used to check the agreement between two sets of cards. Groups of cards in one file are compared with similar groups in a second file. Unmatched cards or groups of cards in either file may be selected or separated from the files.

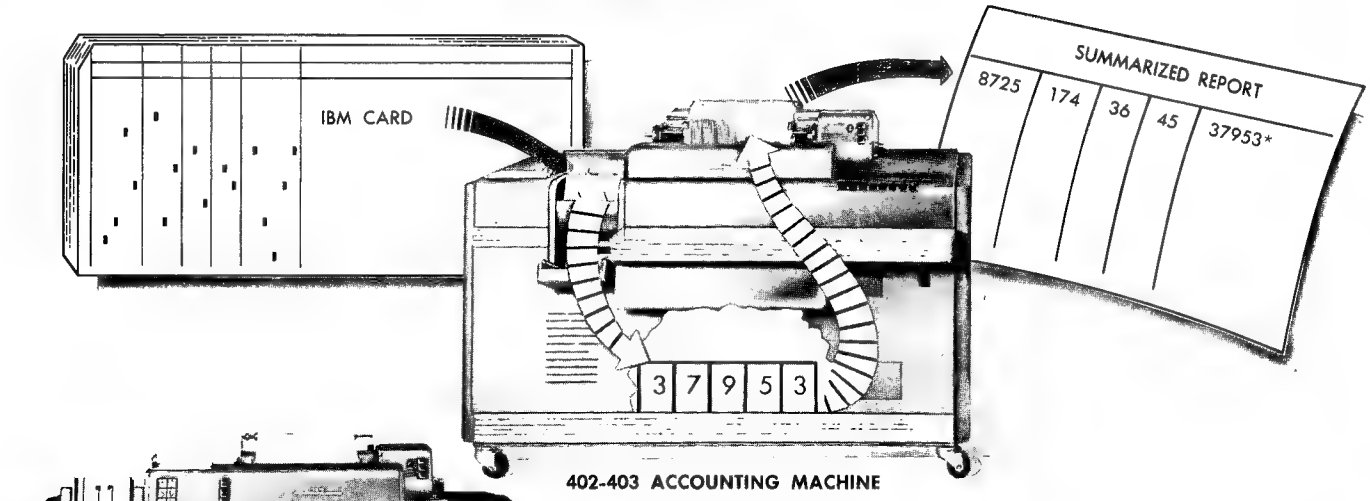
This function is frequently performed in conjunction with merging.



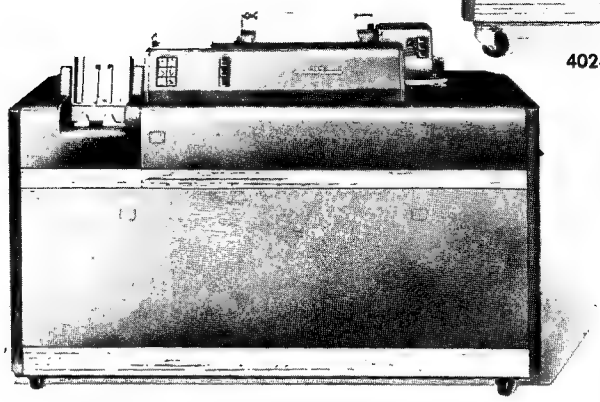
DETAIL PRINTING is the printing of information from each card as the card passes through the machine. The function is used to prepare reports that show complete detail about each transaction.

During this listing operation the machine adds, subtracts, cross-adds or cross-subtracts and prints many combinations of totals.

GROUP PRINTING



402-403 ACCOUNTING MACHINE



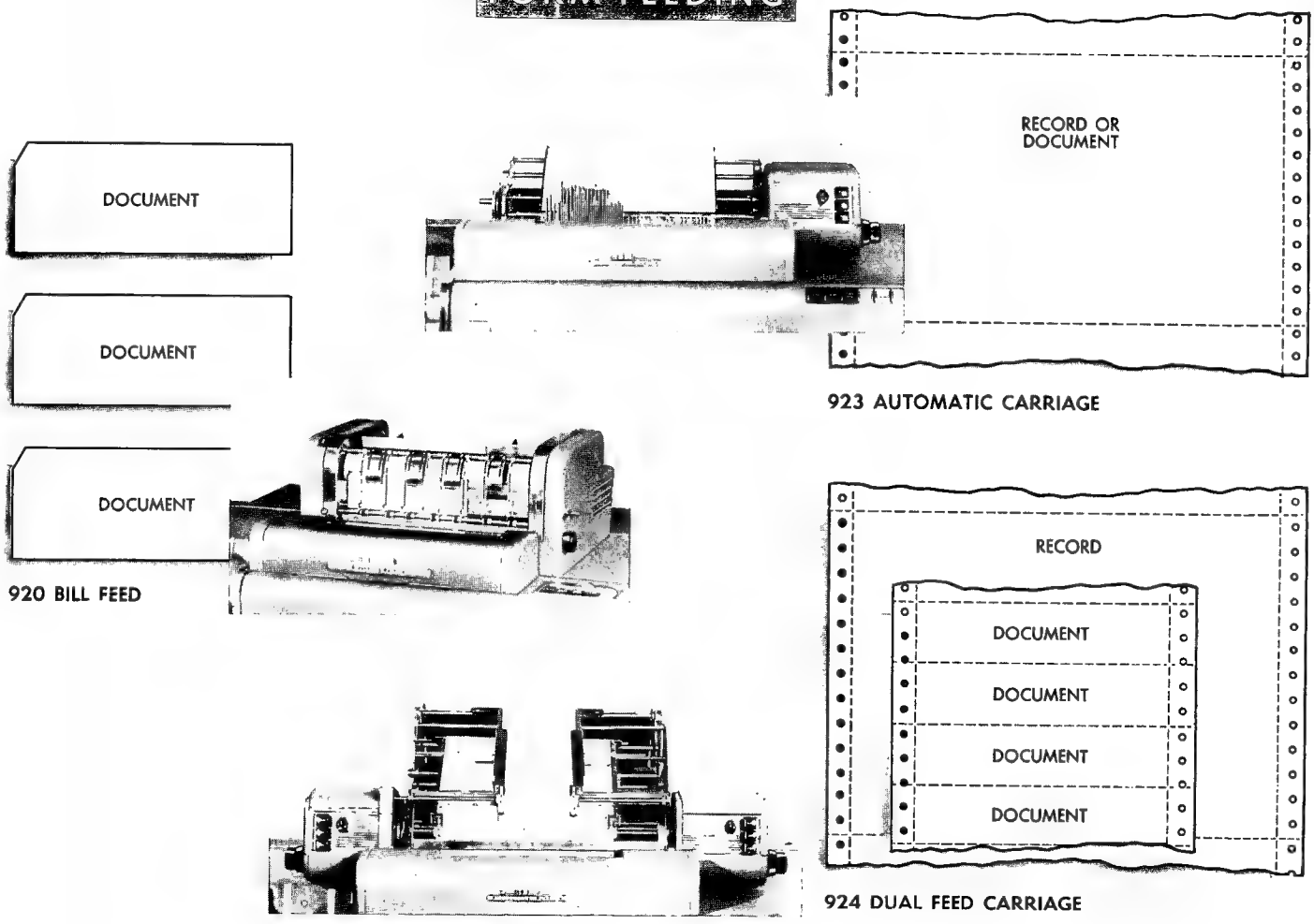
407 ACCOUNTING MACHINE

GROUP PRINTING is the accounting-machine function that summarizes groups of cards and prints the totals on a report. Totals may involve adding, subtracting or crossfooting.

Information read from punched cards is entered into counter units; at the end of each group of cards, the totals are read out of the counters and printed on the report.

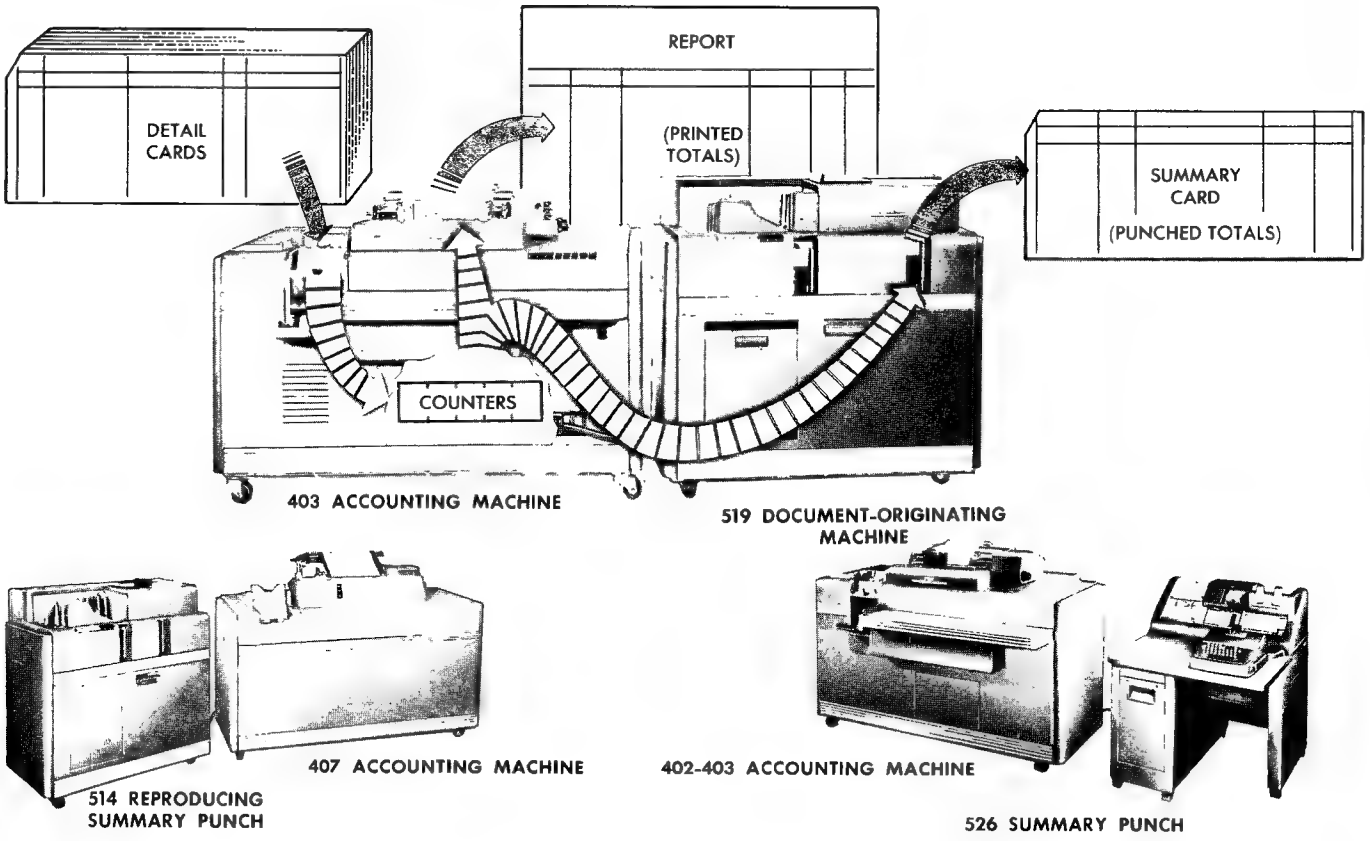
This function is used in preparing all types of reports requiring summarized totals. Complete descriptive information identifies all totals.

FORM FEEDING



FORM FEEDING is the rapid, accurate positioning of reports and documents on which accounting-machine results are printed. The tape-controlled automatic carriage feeds continuous paper forms—single or multiple copies—such as registers, reports, and paper checks. The bill feed positions single forms, such as ledger sheets, envelopes, or IBM cards. The dual-feed carriage feeds two different forms simultaneously, for printing some or all of the same accounting-machine results from the same type bars but with different spacing. All of the devices control feeding within each form, as well as form-to-form ejection.

SUMMARY PUNCHING

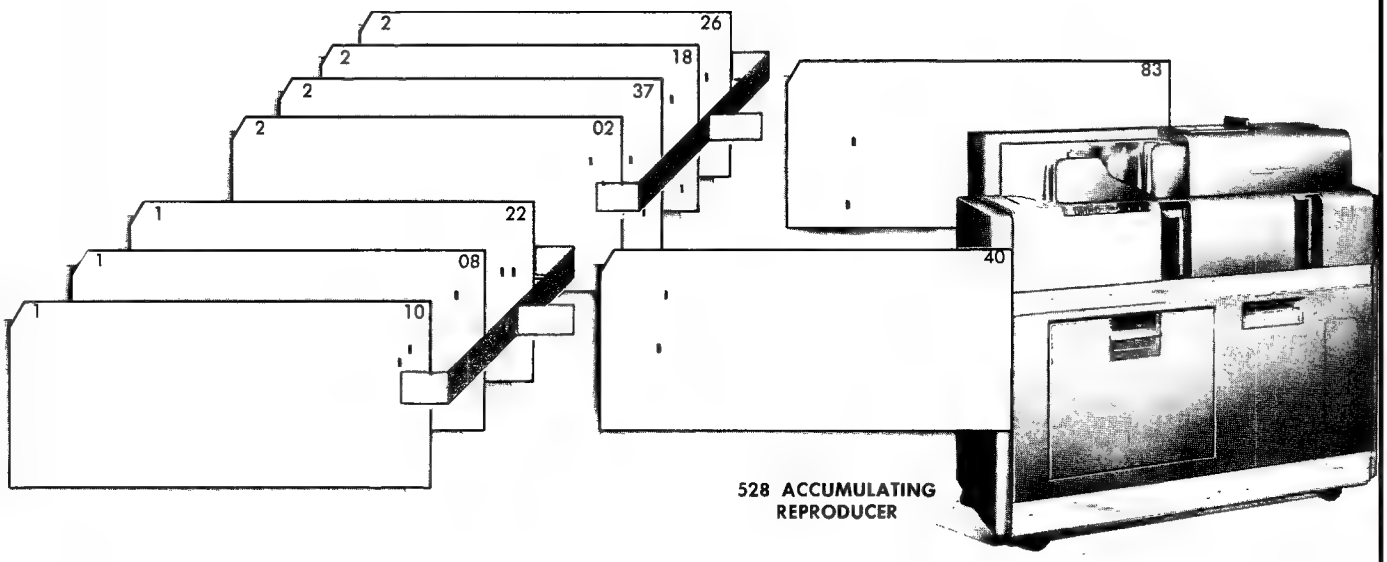


SUMMARY PUNCHING is the automatic conversion into punched-hole form of information developed by the accounting machine. Summary punching is used for two purposes:

1. To carry balance figures forward. To do this, it is only necessary to include the previous total-to-date card with the current card or cards, and, while a current report is being run, summary punch new balance-to-date cards. These are saved for the next balance-to-date operation when the process is repeated.

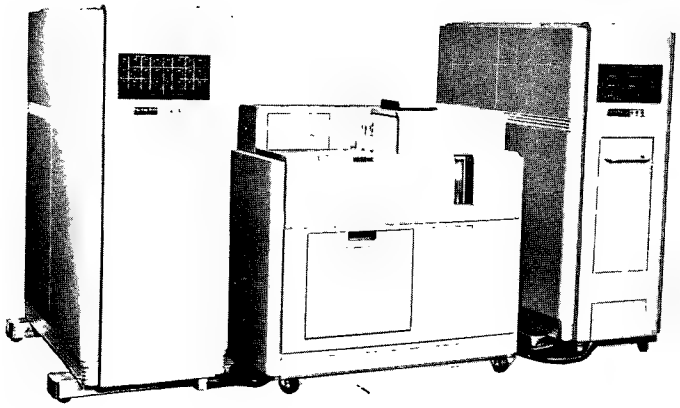
2. To reduce card volume and carry summary data. Summary cards reduce peak-load periods due to accumulated card volume, and can be used as entries to general ledger accounting.

ACCUMULATED TOTAL PUNCHING

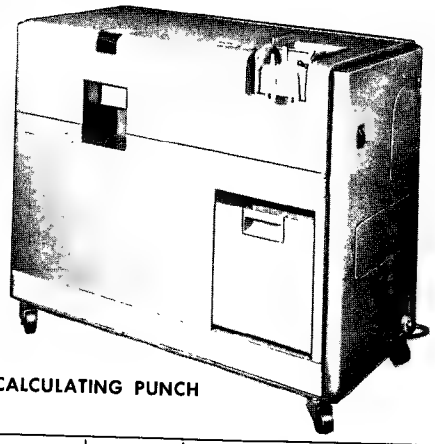


ACCUMULATED TOTAL PUNCHING is the summarizing of detail card information and the punching of a card for the accumulated totals. This is accomplished on the accumulating reproducer through the use of net-balance counters. Classified cards are read and accumulated at the rate of 200 cards per minute, and a summary card is punched for the accumulated totals at the rate of 100 cards per minute. Availability of counters enables the accumulating reproducer to be used as an independent summary punch, without the accounting machine, whenever printed reports are not required. The accumulating reproducer can also be used in conjunction with the accounting machine as a summary punch, thereby increasing total accumulating capacity.

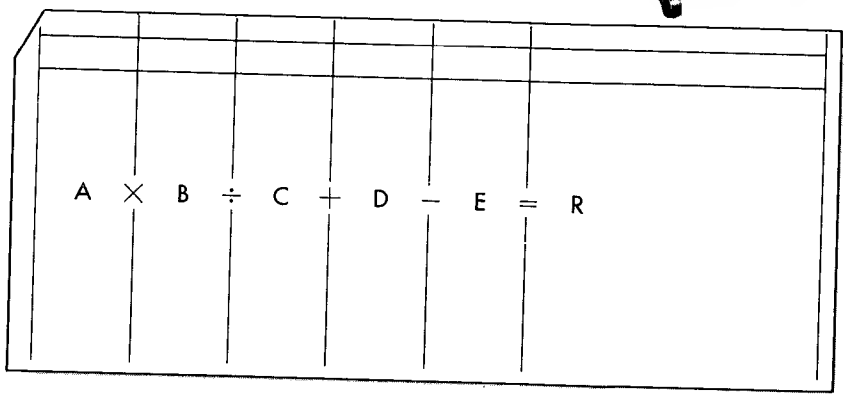
CALCULATING



607 ELECTRONIC CALCULATING PUNCH
(604 IS SIMILAR)



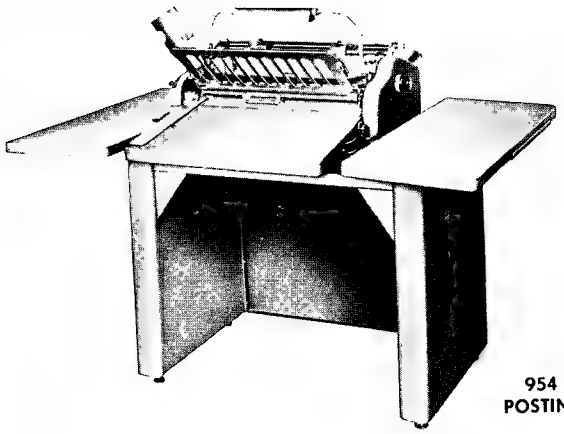
602A CALCULATING PUNCH



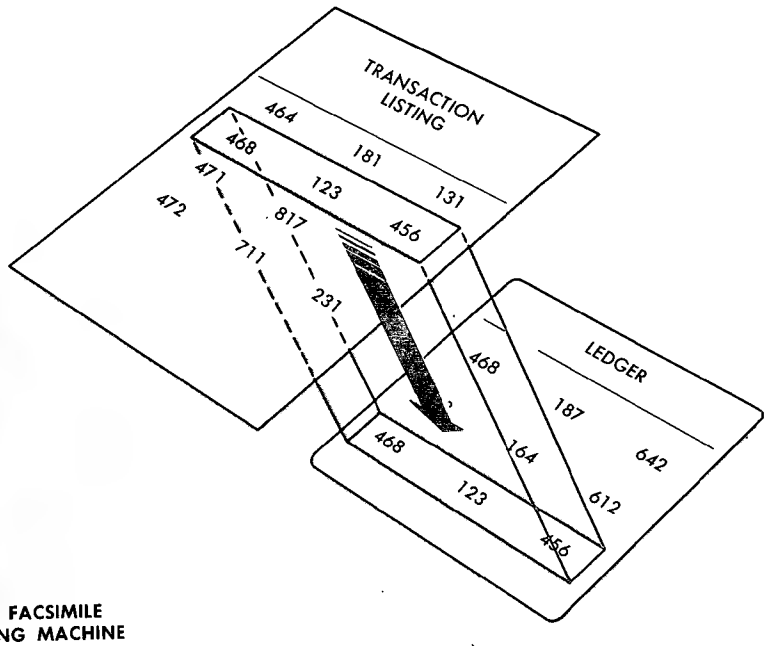
CALCULATING is the computing of a result by multiplication, division, addition, or subtraction. Any combination of these calculations can be performed—often in one run. Factors to be calculated may be read from each card, or series of cards, emitted by a device within the machine, or be developed by the accumulation of a series of calculations. One or several results are punched in each card or in a trailer card which follows a group of cards carrying the factors.

Many routines allow automatic checking to prove accuracy of calculations. For example, to check the punched result, an A × B calculation can be cross-proofed against a B × A calculation during the same run.

FACSIMILE POSTING



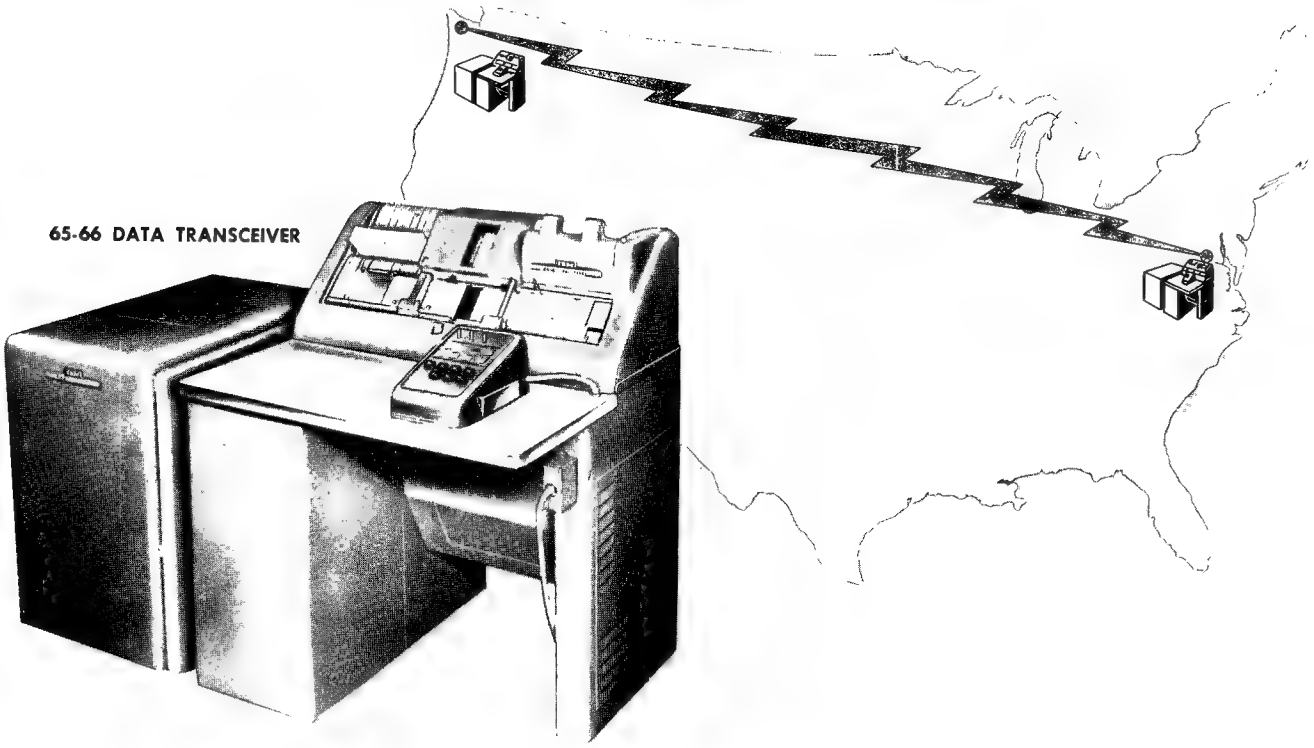
954 FACSIMILE POSTING MACHINE



FACSIMILE POSTING is the process of transferring by a duplicating process a printed line on a report to a ledger or other record sheet. These may be posted from a transaction listing previously prepared on the accounting machine.

Typical uses of this function are the posting of customer ledgers, employees' earning records, and stock ledger cards.

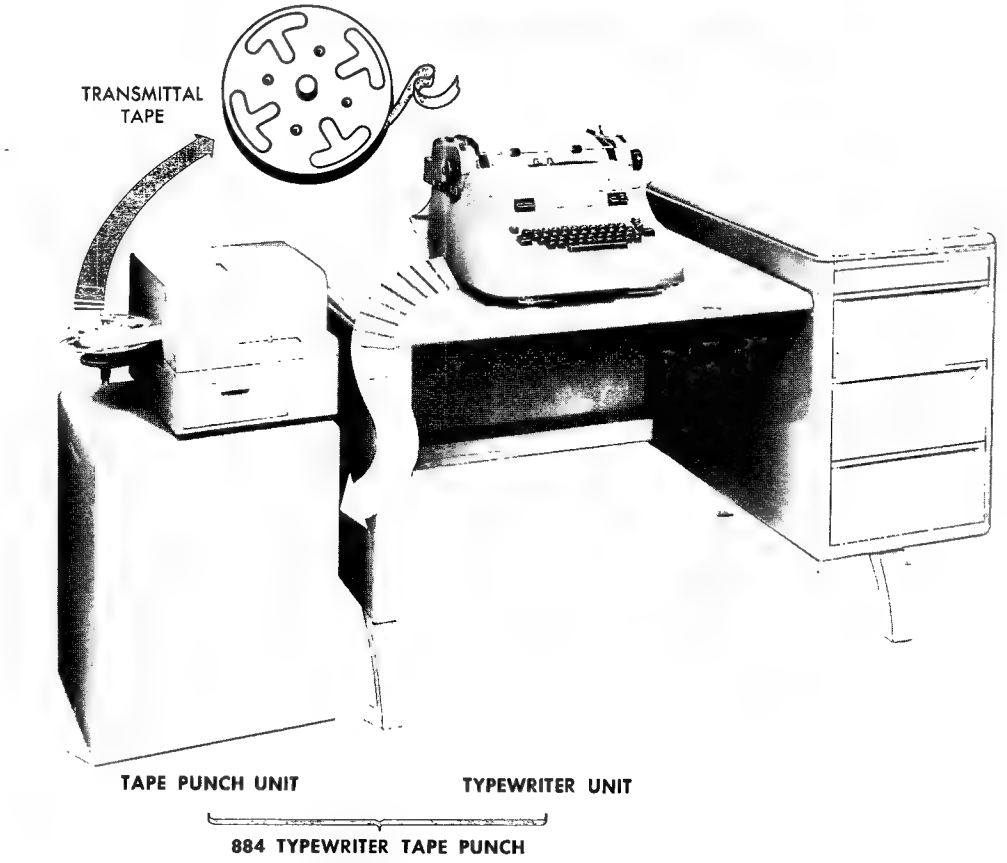
CARD-TO-CARD TRANSCEIVING



CARD-TO-CARD TRANSCEIVING makes possible instantaneous and accurate duplication of punched cards over telephone and telegraph networks between locations separated by either just a few miles or thousands of miles. A switch on the machine halts card transmission at any time to permit direct voice communication over the same telephone circuits connecting the sending and receiving units.

The machines at either end of a circuit are identical and can be used interchangeably for transmitting or receiving.

TYPEWRITER TAPE PUNCHING

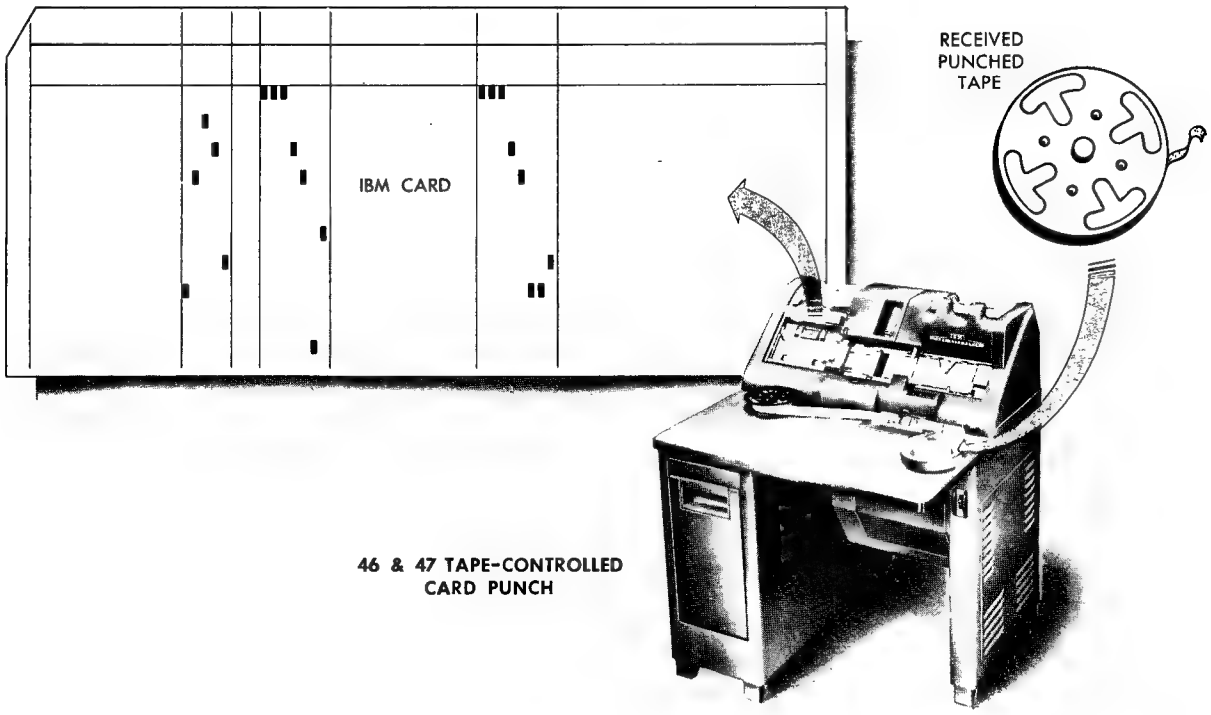


TYPEWRITER TAPE PUNCHING is a means of recording information in code onto a tape by use of a special IBM typewriter. As a document is being created on the typewriter, any or all of the typed information can be recorded on the 8-channel tape. The tape can be easily transported to other locations and processed through a tape-to-card punch to transfer the information into punched holes in IBM cards.

In general, the typewriter tape punch can be used to prepare any document now created on a typewriter and later used as a source document for key punching and key verifying cards; this eliminates the need for the latter two functions.

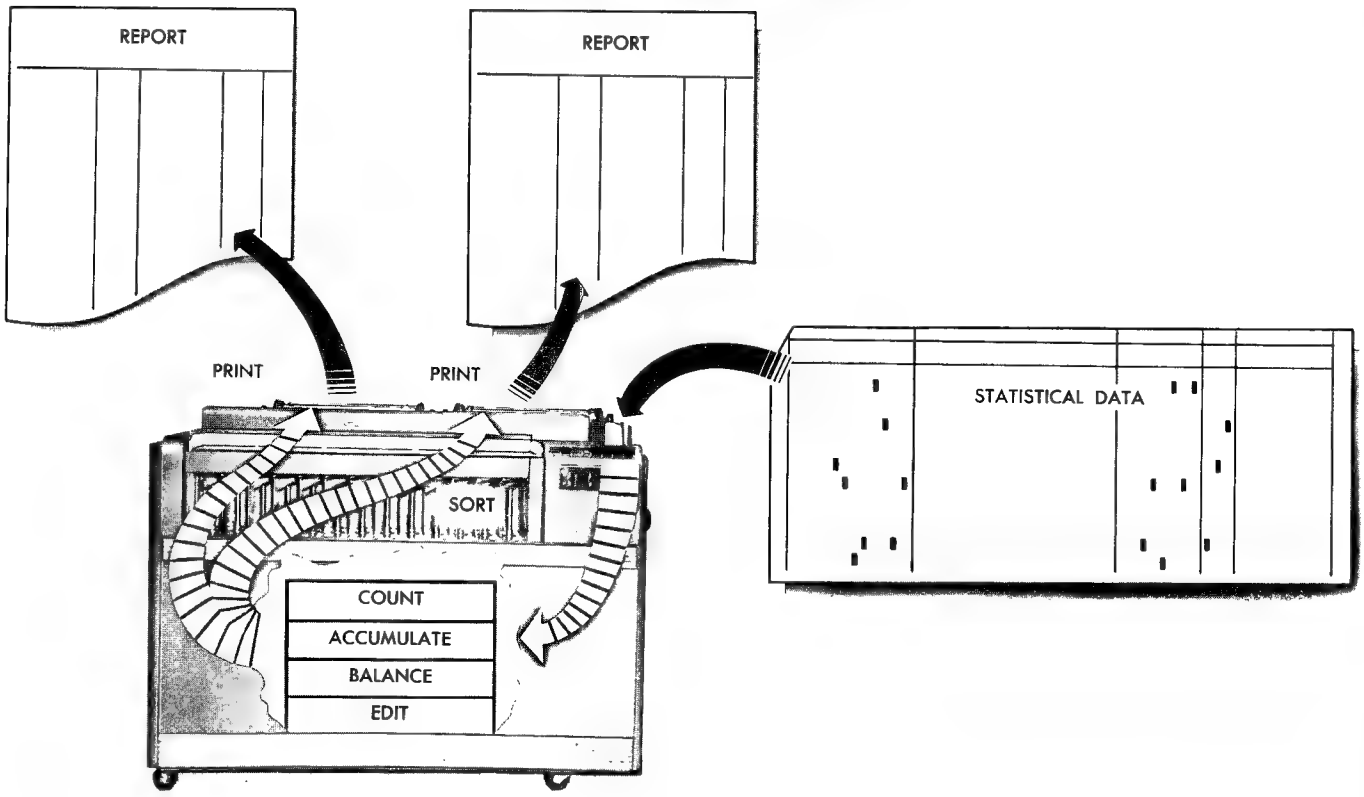
Typical applications of this machine are for billing, order writing, personnel changes, address changes, insurance policies, railroad accounting, journal vouchers, purchase orders, receiving reports, directories, inventory control, check reconciliation, and many more.

TAPE READING



TAPE READING is a process of feeding coded tapes through a tape-to-card punch to convert the coded information into IBM punched cards. Tapes can be prepared on the typewriter tape punch or on the card-controlled tape punch; the latter is capable of punching tape that can be transmitted by telegraph.

STATISTICAL WORK

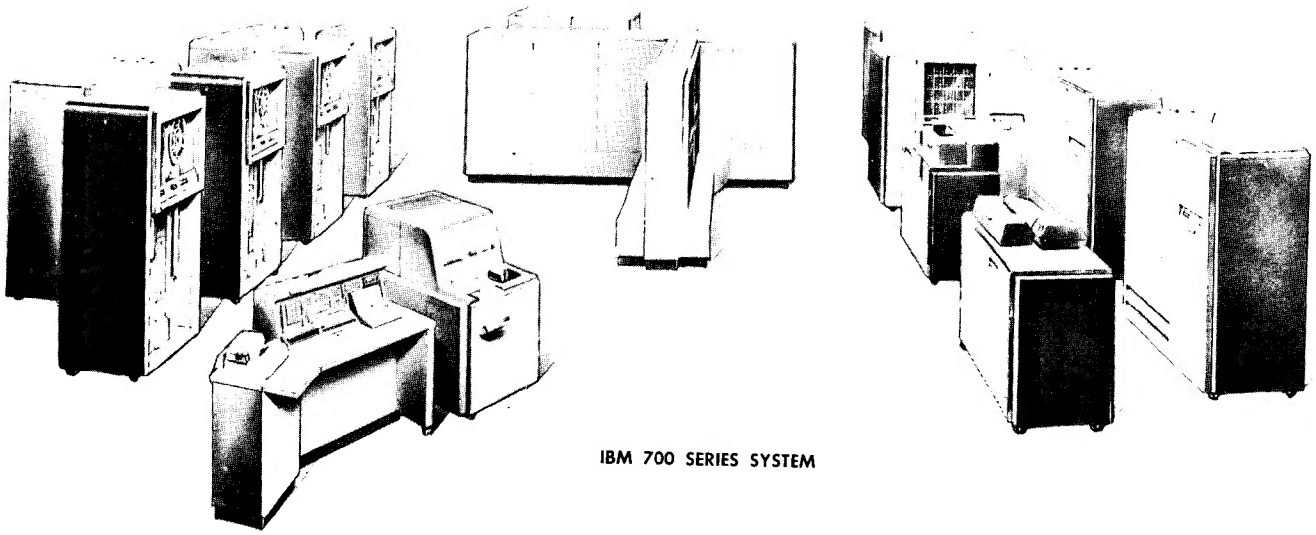


101 ELECTRONIC STATISTICAL MACHINE

STATISTICAL WORK is essentially a problem of counting units in many different classifications. At the same time it is frequently desirable to accumulate certain quantities or amounts, check or edit for consistency or reasonableness, and balance counts to the control totals to check the accuracy of the summaries.

All of these functions are performed by the Electronic Statistical Machine to produce printed summaries. This machine also performs sorting and card-arranging operations.

DATA PROCESSING



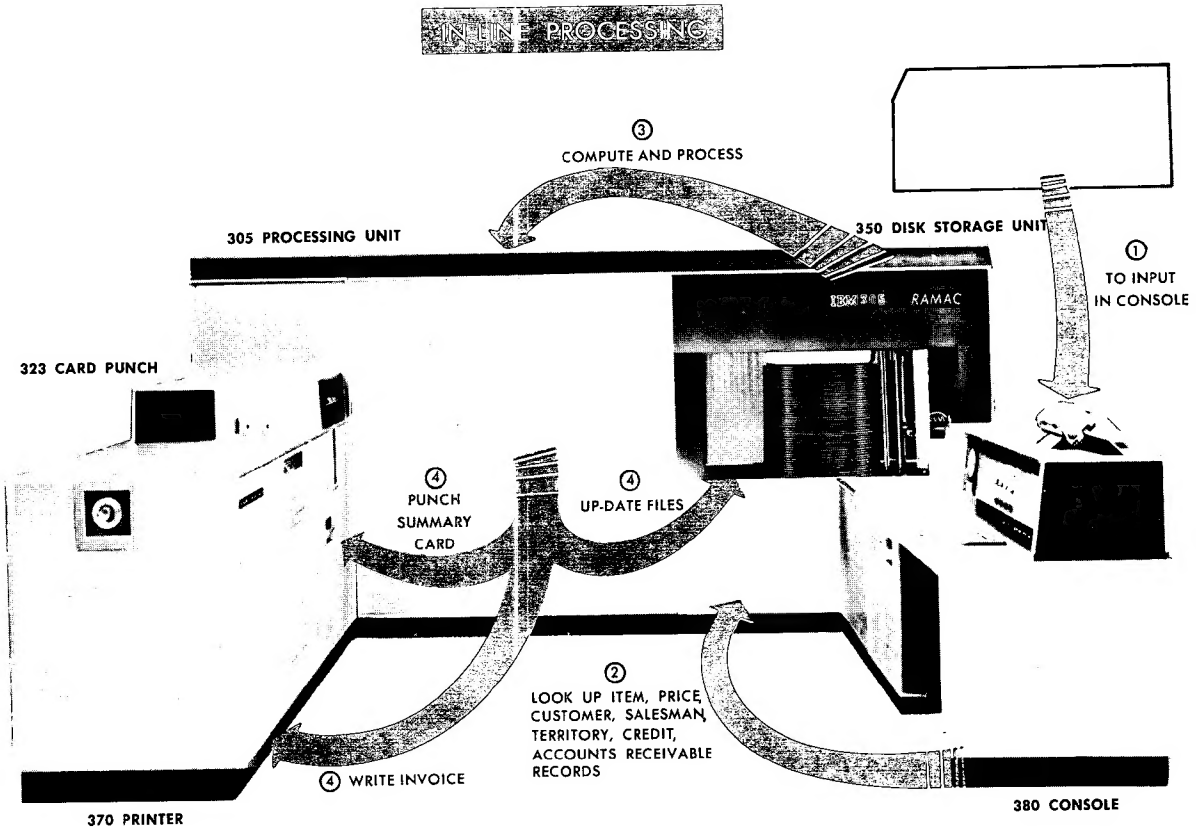
IBM 700 SERIES SYSTEM

DATA PROCESSING, from a machine standpoint, entails entering a complete set of instructions as well as initial source data into the machine to enable it to arrive at the completed final results or reports in one operation.

This type of data processing requires the programming of each step in the procedure—including the solution to all exceptions—before source data are to be processed. Through the use of cards, magnetic tapes, magnetic drums, electrostatic storage, and printing units, the machines are capable of high-speed input-output and internal logical ability.

Such features permit accurate processing of large procedures and complex problems at high speed.

Stored Programming is the function of entering or "loading" of all instructions into the machine in the proper sequence to perform the steps necessary to complete a given application or problem from data "loaded" in a similar manner.



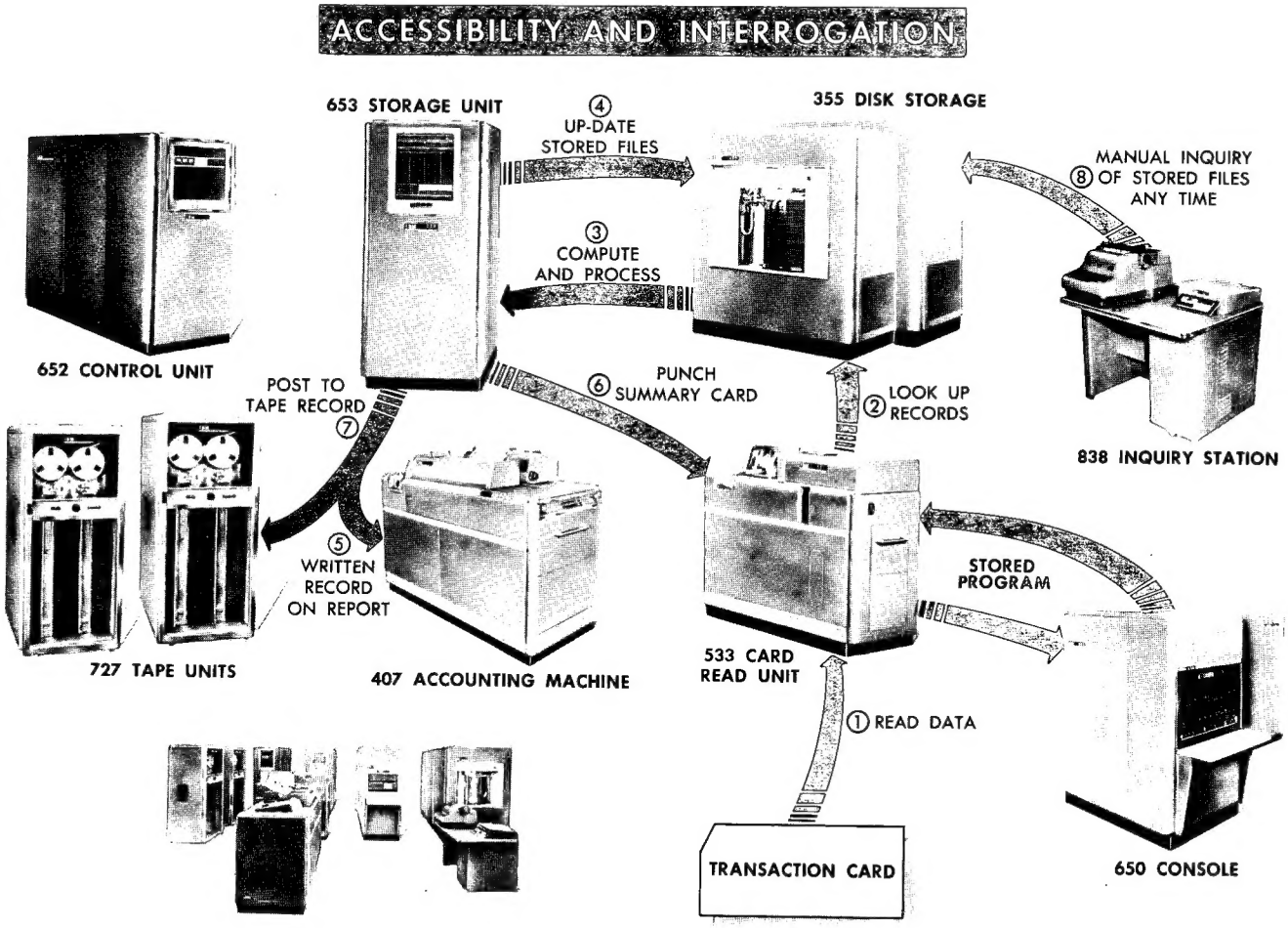
IBM 305 RAMAC

IN-LINE PROCESSING means posting transactions to all ledger accounts affected as they occur. For example, processing a customer order changes the inventory status of all items ordered, and alters accounts-receivable and sales records, too. All these accounts can be updated at one time. Thus, they represent today's status, not yesterday's, last week's, or last month's.

A machine needs high-capacity storage so that all types of accounts can be included. In addition, each record of each account must be readily obtainable.

RANDOM ACCESS METHOD OF ACCOUNTING AND CONTROL describes the functions of the 305 RAMAC®. A disk-storage unit has a capacity of 5,000,000 alphamerical characters in 100-character groups, each such record available in less than one second.

The RAMAC uses stored programming, on a magnetic drum. The machine has printed, punched, and typed output, and allows interrogation of any of the stored records.



IBM 650 RAMAC

ACCESSIBILITY AND INTERROGATION provide ease in handling problems requiring large-capacity random-access storage. This system not only allows the records in disk storage to be updated as the transactions occur, but also makes it possible to inquire about the status of any record, in less than two seconds.

The advantages of stored programming and in-line data processing are combined to handle problems ranging from payroll processing, through elaborate inventory and manufacturing controls, to complex scientific applications.

Data can be entered into the system from magnetic tapes, punched cards, manual inquiry stations, or information previously stored in the magnetic disks. Output results can be in any of these forms: printed, punched, or typed.

IBM®

224-8208-3 (11/61: 30M — W)

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